Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

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DOUGLAS McKAY, Secretary

FISH AND WILDLIFE SERVICE

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Commercial Fisheries Abstracts

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In addition to the regular abstracts, there is included a bibliography of references of secondary importance (without abstracts). These may be cut off on the lines designated and pasted on standard 3 x 5-inch cards for filing.

Following is a brief outline of this filing system. The numbers apply to the first digit appearing on each card. For the meaning of subsequent digits, please see the above described leaflet.

0 General and theoretical
1 Fish by species
2 Fresh fish
3 Preserved fish
4 Oils
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8 Composition
9 Miscellaneous

Issued with the approval of the Bureau of the Budget, December 29, 1950

0.32 STUDIES ON THE MUSCLE OF THE AQUATIC ANIMALS. 11. ON THE DENATURATION OF FISH MUSCLE PROTEIN CAUSED BY FREEZING AND SALTING, AND THE RELATION BETWEEN THEM

Simidu, Wataru and Hibiki, Sigeyuki
Bulletin of the Japanese Society of Scientific Fisheries 17, No. 10, 301 (1951)

The authors attributed the greater denaturation of water-soluble protein at -2°C. than at 0°C. to the effect of the concentration of salts in the muscle during freezing. To study this effect, various quantities of salt were added to samples that were then stored at temperatures just sufficient to prevent freezing. It was found that, up to a certain point, there was a direct relationship between the concentration of salt and the denaturation of protein.

A theoretical discussion of this relationship is presented (in Japanese). It is illustrated by five figures (all labeled in English).

 ABSTRACTER: Roy C. Stevens

0.33 THE PROTEIN-SUGAR REACTION

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 24-25 (1952)

Insulin, like casein, reacts most rapidly with glucose in the solid state at a moisture content that is in equilibrium with a relative humidity of approximately 70 percent. After 4 days at 65 percent relative humidity and 37°C. (98.8°F.), 70 percent of the phenylalanyl α-amino groups, 37 percent of the glycyl α-amino groups, and 21 percent of the lysyl ϵ-amino groups had reacted with the sugar.

The two reducing sugars 2-deoxy-D-galactose and 2-amino-D-glucose in their reactions with casein caused much more rapid browning than did either unmodified galactose or glucose. Further study showed the glucosamine browning reaction to be of an entirely new type. Specifically, the surface of the protein appeared to provide a more alkaline environment than would have been expected from the pH (6.3) of the solution from which it was dried. As a consequence, the glucosamine decomposed so rapidly that the ordinary sugar aldehyde-protein amino group reaction did not occur. This particular surface action of the protein reached a maximum at a moisture content corresponding to about 80 percent relative humidity. In the completely dry solid and in the dilute aqueous solution, however, this surface action was practically absent.

 ABSTRACTER: Martin Heerdt

0.33 CAUSE OF THE BROWNING OF CERTAIN HEAT-PROCESSED FISH PRODUCTS

Tarr, H. L. A. (Pacific Fisheries Experimental Station, Vancouver, B. C.)
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 92, 23-24 (October, 1952)

From experiments conducted at the Vancouver Station and reported in Progress Reports No. 74, 1948, the discoloration or browning of certain white-fleshed fish during heating was concluded to be due to the interaction of the flesh protein with its normal sugar constituents. This change is usually known as a "sugar-protein" or Maillard reaction and may occur under conditions similar to those common to normal canning procedures.

In the present work the degree of browning was measured with fair accuracy by the use of a light reflectance accessory attached to a Beckman model DU spectrophotometer. Halibut or lingcod that had been heated at 212°F. for 20 minutes, for example, yielded 90 percent of the reflectance of the gel-like, chemically-prepared surface of an absolutely white reference muscle. Reflectance values for other varieties of fish that were heated for 1 hour at 248°F. appear in the table, this card, over.

Fish muscle was found to contain from 0.1 to 0.3 percent total ribose. Much of this sugar, however, was combined in the form of inactive nucleosides or nucleotides. Separation of free ribose for identification was accomplished by extracting fresh or frozen muscle with cold alcohol, filtering, and evaporating to dryness in a high vacuum. A concentrated aqueous solution of this dried material, when chromatographed on filter paper, made possible the identification of glucose as well as ribose as regular constituents

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 ABSTRACTER: Martin Heerdt

0.6 FISHY FLAVORS

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 25 (1952)

The development of "fishiness" in freeze-dried plasma can be prevented by the complete exclusion of oxygen. If as little as 0.7 percent oxygen is allowed to remain in the container, however, a fishy flavor becomes evident after only 8 days of storage. The increase in the fluorescence of the reconstituted plasma during storage has been shown to be related to the quantity of oxygen previously absorbed by the dried material and to the degree of fishy-taste development.

The formation of fishy flavors may result from the direct interaction of trimethylamine oxide with unsaturated fatty acids. For example, at 100°C. (212°F.) the oxide may be reduced rapidly to trimethylamine by esters undergoing autoxidation or by preoxidized esters in the absence of oxygen. At 37°C. (98.5°F.), however, reduction of the oxide is very slow, and neither haemoglobin nor pork muscle homogenate will catalyze the reaction. Participation of trimethylamine oxide in the production of fishy flavors other than by the process of reduction by micro-organisms has never been substantiated with evidence.

 ABSTRACTER: Martin Heerdt

DENATURATION OF FISH MUSCLE PROTEIN

PROTEIN-SUGAR REACTION

PROTEIN-SUGAR REACTION

FISHY-FLAVOR DEVELOPMENT

0.33 (Cross Reference: 3.33)

of fish muscle. These two sugars occur singly or together in variable amounts, but ribose is the sugar that is largely or entirely responsible for browning. It is believed that fish muscle must contain significant quantities of ribose for extensive discoloration to occur in canning. Surprisingly, free ribose is not present in any quantity in the muscle of live fish, but is formed after death from the nucleic acid derivatives.

Reflectance as a measure of browning cannot be used in the case of red-fleshed salmon and certain species of tuna because of the interference of the flesh pigments. None of the species of salmon tested have yielded over 0.005 percent of free muscle ribose; however, a glucose content of 0.074 percent was found in pink salmon. The accompanying table shows the relationship between the free ribose content of various species of fish and the degree of browning that resulted on retorting the flesh for one hour at 248°F. (as may occur in some canning procedures).

Variety of fish	Free ribose content (%)	Reflectancy of heated flesh (%)
Mullet (freshwater fish)	Negligible	69
Halibut	0.035	63
Albacore tuna (fresh)	0.007	57
Albacore tuna (frozen)	0.03	56
Albacore tuna (frozen, old fish)	0.029	59
Bonito (frozen, old fish)	0.18	48
Lemon sole	0.14	40
Skipjack tuna	0.20	37
Lingcod	0.55	33
Red Cod	0.24	28

0.32 (Cross References: 3.234, 3.5)

2.02 MUSCLE PHYSIOLOGY AND BIOCHEMISTRY

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 21-22 (1952)

The decrease in volume that occurs when adenosine triphosphate (ATP) is added to muscle-breis can be modified by the presence of an unknown factor. Work with this factor has been extended to include a study of its effect upon muscle strips 30 mm. long by 0.3 to 1.0 mm. in diameter that have been treated to destroy the semi-permeability of the membranes. Adding 0.008-M ATP to the washed muscle strips caused a rapid shortening under load, and the total work performed amounted to 50 to 150 g.cm-g. In the presence of an extract containing the unknown factor, however, the addition of ATP caused a decidedly slower and less marked shortening. Furthermore, some lengthening of the loaded muscle was a frequent occurrence when shortening was complete, a phenomenon that was never observed in the absence of the factor.

Additional information was obtained by using the effect of the unknown factor in reducing the adenosine triphosphatase activity of muscle-breis from 1/4 to 1/10 of their original activity. This is a phenomenon that parallels the effect of changes in the volume of the muscle fibers. Measuring the reduction of adenosine triphosphatase activity confirmed the extreme lability of the factor to acid and heat. Further experimentation has shown that the factor consists of a heat- and acid-labile non-dialyzable fraction, probably of protein nature, and a heat-labile dialyzable fraction, one part of which appears to consist of a substance having a molecular weight ranging from 10,000 to 20,000. Freeze-drying is the only known means of obtaining the dialyzable fraction from the dialyzate. The factor becomes inactive at ionic strengths below 0.03 M, is reactivated on raising the ionic strength above 0.03 M, is inactivated by calcium ions at 0.006M, and is inactivated by freezing the intact muscle prior to extraction of the factor.

 ABSTRACTER: Martin Heerdt

2.02 IMPROVING THE QUALITY OF FROZEN MEAT

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 20-21 (1952)

It is now known positively that the better the original quality of a frozen beef carcass the less, on an average, will be the amount of drip on thawing. Quarters of average quality frozen beef when defrosted for 3 days at 10°C. (50°F.) and cut into large pieces lost an average of 1 to 2 percent of their weight in the form of drip during the following day. Taken individually it was possible for these cuts to lose as little as no drip or as much as 9 percent of their weight.

When whalemeat is frozen before the onset of rigor mortis, stored at -10°C. (14°F.), and thawed in the normal way at room temperature, the amount of drip that occurs is about 40 to 45 percent of the total weight. Similar meat that was held for a day or two at a temperature of 3°C. (27°F.) before thawing, however, lost only 20 percent of its weight as drip. Freezing apparently destroys an unidentified factor that, when active, reduces contraction of the flesh during rigor mortis. The larger quantity of drip that exudes from whalemeat when it is frozen before the onset of rigor mortis in comparison to that from meat frozen after rigor mortis apparently is due to a more marked degree of contraction in the pre-rigor whalemeat.

The activity of cytochrome oxidase in enzyme preparations from various muscles of certain animals has been shown to be higher when the myoglobin content of the whole muscle is greater. Exercise causes an increase in the myoglobin content of the muscles that are used. The function of cytochrome oxidase in the aerobic cycle is to keep the energy-rich phosphate groups of adenosine triphosphate and creatine phosphate at a high

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 ABSTRACTER: Martin Heerdt

2.01 THE IMPORTANCE OF FLAVOBACTERIUM IN FISH SPOILAGE

Castell, C. H. and Mapplebeck, E. G. (Atlantic Fisheries Experimental Station, Halifax, N.S.)
Journal of the Fisheries Research Board of Canada 9, No. 3, 148-156 (September, 1952)

Although it has been definitely established that species of Flavobacterium are among the principal species found on fish, especially freshly caught fish, there is little conclusive evidence of the part they play in the normal spoilage of fish. The work recorded in the present paper has been done with the object of throwing a little further light on this subject.

Agar plates were poured from 56 samples of the skin and muscle of fresh and frozen cod and haddock. From each set of plates, representative yellow and orange colonies were picked off and, after initial microscopical examination, the cocci were discarded. From the remaining rod-types, 245 cultures were obtained having the general characteristics of Flavobacterium. Only six were definitely Gram-positive, the remainder being either Gram-negative or Gram-variable. The majority of the cultures were composed of rod-shaped cells, but there were also many that showed extreme pleomorphism, and some that were composed of coccoid cells, difficult to distinguish from ordinary Gram-negative cocci.

Two different methods were used to estimate the capacity of these organisms for spoiling fish. First, tests were made to determine their ability to hydrolyse fat, to reduce trimethylamine oxide, to decompose proteins (gelatin and casein), to ferment sugars and to grow at temperatures close to freezing. Secondly, in a more direct method, sterile cod muscle was inoculated with pure cultures of these organisms and incubated at 3° and at 25°C. Similar sets containing 0, 5, 8 and 12 percent sodium chloride were incubated at 25°C. These were all examined daily for the production of off-odours and any physical change that might occur in the fish flesh.

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 Reprinted in part

0.5 THE FLORA OF ARCTIC COD

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 10-11 (1952)

Chitin-digesting bacteria have been found in the slime and intestines of all of the North Sea fish examined to date. Many of these bacteria are so active on primary isolation and in mixed culture as to clear chitin agar plates within 48 to 72 hours at 25°C. (77°F.). Of the seventy cultures thus far isolated, most have been provisionally classified as belonging to the Pseudomonas, Flavobacter, and Corynebacter groups. In the case of some of these bacteria, pleomorphic changes were observed to occur with the aging of the colonies on artificial media. Others showed typical smooth and rough colony variants. Of the 80 stock cultures obtained from Arctic cod and examined on chitin agar, at least four were found to be chitinivorous. These four strains all belonged to the Pseudomonas group.

A total of 80 well-documented culture strains from Arctic cod, consisting of Achromobacter, Pseudomonas, Corynebacterium, and Micrococcus species, were used to investigate the effect of certain antibiotics on marine bacteria. Almost all of the strains could be held in check by one or another of the following antibiotics: penicillin, aureomycin, chloromycetin, terramycin, streptomycin, and aerosphorin. Certain strains of Achromobacter when grown in penicillin-containing media exhibited long, thread-like forms with unusual shapes such as swellings, spirals, clubs, etc.. Some of the antibiotics actually produced gram negative cells with peculiar gram positive granules in a strain of Corynebacteria that was normally gram positive.

 ABSTRACTER: Martin Heerdt

MUSCLE PHYSIOLOGY AND BIOCHEMISTRY

FLAVOBACTERIUM IN SPOILAGE OF FISH

QUALITY OF FROZEN MEAT

FLORA OF ARCTIC COD

2.01

None of the organisms tested fermented either lactose, sucrose or dextrose. Many cultures in these sugar broths ended up with a strong alkaline reaction. None hydrolysed either butter fat or cod liver oil. Of the orange cultures, only a very few slowly reduced trimethylamine oxide or sodium nitrate. Almost half of the yellow cultures reduced nitrate and about one-quarter reduced the oxide. As a group, these organisms were much more active in their ability to decompose proteins (gelatin and casein). Almost all of the organisms grew slowly at 2° to 3°C. and produced their typical pigmentation. The ability of the organisms to grow in broth containing various concentrations of sodium chloride was to some extent determined by the size of the inoculation.

Pieces of sterile fresh cod muscle, and also similar fish muscle that had been autoclaved, were inoculated by dipping them into suspensions of pure cultures. For comparison, similar fish samples were inoculated with suspensions of Pseudomonas. These were held in sterile glass containers, incubated at both 3° and 25°C. and examined periodically for spoilage odours. At 25°C., in each case where the fish was inoculated with Pseudomonas, there was a pronounced off-odour within 24 hours and at 48 to 72 hours, the fish were quite putrid. The majority of the orange cultures of Flavobacterium, especially those which were strongly proteolytic, had a pronounced off-odour at 48 to 72 hours, but not at 24 hours; at four to five days, most of these were extremely offensive. The yellow cultures of Flavobacterium produced off-odours more slowly, and the odours themselves were much less offensive.

From 3 to 5 percent sodium chloride in the fish made either no difference or accelerated the production of spoilage odours. The growth on salted fish muscle differed from that in the nutrient brine, in that the orange cultures grew at 5 but not 8 percent and the yellow cultures at 8 but not 12 percent salt.

Tests such as those described above have very definite limitations when the results are used for interpreting the spoilage that occurs with the normal mixed mocroflora.

0.5 (Cross Reference: 1,5)

2.02 (Cross Reference: 3.239)

level. It may be assumed therefore, that oxymyoglobin acts to provide a supply of readily available oxygen for cytochrome oxidase.

The myoglobin content of Blue Whale muscle was found to be about equal to that of horse muscle; however, whale muscle contained only about one-third as much cytochrome oxidase as horse muscle. When the rate of utilization of oxygen per gram of muscle was calculated for both animals, the whale was found to require only about one-twelfth as much oxygen as the horse.

0.33 BROWNING OF SALT FISH

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 10 (1952)

During the late summer of 1950 several salt fish producers reported a brown discoloration on their wet-stocked, salt fish. The cut surfaces of these cod, ling, and coalfish, which had been caught and salted aboard ship in the Bear Island and Barents Sea areas, were discolored by a brown, iron-like stain. Investigations have not as yet indicated the cause of the brown stains, but it is possible that the Maillard reaction was involved or that the salt used was too pure.

Thus far, Bear Island cod have been more subject to browning than North Sea fish. Similarily, when pure salts are used more browning results than when less pure solar salts are used. The substance or substances in solar salts that prevent browning are definitely known to be non-organic in nature. When Ca, Mg, K, and SO_4 ions were added to pure salts in amounts equivalent to the amounts in solar salts, browning was reduced but not completely prevented, even in North Sea fish.

 ABSTRACTER: Martin Heerdt

4.15 COMPONENT FATTY ACIDS OF INDIAN SHARK LIVER OILS

Pathak, S. P.; Agarwal, C. V. and Mathur, S. S. (Benares Hindu University, Benares, India)
Journal of the American Oil Chemists' Society 24, No. 12, 593-596 (December, 1952)

This paper reports on the fatty acid composition of two samples of liver oil from the Indian shark Galeocerdo rayneri. Sample 1 was taken from shark caught in the Arabian Sea; sample 2, from shark caught in the Bay of Bengal.

These samples belonged to Tsujimoto's fourth group of Elasmobranch liver oils in that they had high saturated acid content (about 40 percent). Oils of this group are rare. The liver oil from the Galeocerdi rayneri appears to be only the third instance of this peculiar group. The present study is probably the first detailed analysis of this type of oil in which an efficient modern fractionating column was employed.

Tsujimoto's lithium-salt acetone method was used in the separation of the highly unsaturated acid fraction yielded by the mixed acids from sample 1. The modified technique of Lovern was followed in the analysis of sample 2. The insoluble acids were further resolved into two fractions, using Hilditch's modified lead-salt alcohol method. Each group of acids was separately converted into methyl esters and then fractionated through the Longenecker E.H.P. column.

Sample 1 contained 40.9 percent saturated acids (palmitic, 24.9 percent; stearic, 11.1 percent; myristic, 3.3 percent; and minor percentages of lauric, arachidic, and lignoceric) and 59.1 percent unsaturated acids (C_{16}, 11.2 percent; C_{18}, 19.6 percent; C_{20} and above, 27.1 percent; also some C_{12} and C_{14} monoethenoids).

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 ABSTRACTER: F. Bruce Sanford

0.32 SETTING PHENOMENON OF FISH MUSCLE. I. INFLUENCE OF ELECTROLYTES

Migita, Masao and Okada, Minoru
Bulletin of the Japanese Society of Scientific Fisheries 18, No. 3, 117-123 (1952)

On standing, the sticky paste formed when fish muscle is ground with appropriate amounts of certain salts turns to an elastic jelly and loses its stickiness. The process is thought to involve two stages: (1) peptization of muscle protein (myosin) and (2) gelatination of the sol thus formed.

In trying to find the reason why two opposite actions, peptization and gelatination, can take place under the same conditions, the authors examined the influence of different salts on the setting of horse mackerel flesh. They found that salts can be divided into three groups with respect to their effect on the setting of flesh:

Group	Characteristics	Salts
I	Forms sticky paste that does not turn to elastic jelly	Fluorides, sulfates, phosphates, acetates and citrates of alkali metals
II	Forms an elastic jelly sooner or later	Chlorides, bromides, iodides, nitrates and rhodanates of alkali metals; Mg salts; Acetates of alkali-earth metals; sulfates of Mn, Co^{II}, Fe^{II}, Ni^{II}
III	Coagulates proteins with simultaneous dehydration	Salts of heavy metals and polyvalent metals

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 ABSTRACTER: F. Bruce Sanford

2.00 PRESERVATION AND QUALITY OF WHALEMEAT

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 22-23 (1952)

Surface drying and the development of surface rancidity must be prevented if whalemeat is to be stored in the frozen state. Both forms of deterioration can be avoided if the frozen meat is covered with a water-ice glaze approximating 1 mm. in thickness. Minced whalemeat that became rancid in 5 days when stored at -3°C. (26.6°F.) could be protected for 2 to 3 weeks simply by adding an antioxidant such as 0.05 percent ascorbic acid or ethyl gallate.

The presence of the three methylamine bases and trimethylamine oxide in whalemeat has been proved by the new liquid-gas chromatographic method of analysis. These three bases and the oxide are usually associated with stale flavors in sea fish. The total quantity of all three bases, determined after reduction of the trimethylamine oxide present, amounted to only 0.01 to 0.02 percent of the weight of the samples. This is about one-tenth of the quantity normally found in the muscular tissues of marine fish. No relationship between the presence of the methylamines and the incidence of fishiness has ever been established.

Bacteriologically, whalemeat is unique in that bacterial growth in the dead whale cannot proceed until rigor mortis has set in. Attempts to substantiate this finding in the case of horsemeat have failed completely; however, the whale presents peculiarly favorable conditions for such observations. Specifically, the pre-rigor state in the whale is prolonged and the temperature remains near that of the living animal even longer.

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 ABSTRACTER: Martin Heerdt

BROWNING IN SALT FISH

ELECTROLYTIC SETTING OF FISH PROTEIN

FATTY ACIDS OF INDIAN SHARK LIVER OILS

WHALEMEAT QUALITY

0.32

It was observed that the salts of alkali metals belong to either Group I or II and that they exert different effects according to the kind of anion present, whereas no appreciable differences were found when the cation was varied. The differences observed in Mg salts, acetates of alkali-earth metals, sulfates of Mn, Co^{II}, Fe^{II}, and Ni^{II} were due to the influence of the cations. The effect of the heavy-metal salts was thought to be associated with the formation of metal-protein complexes.

The authors found that the effectiveness of anions to induce setting was in the following order:

$$Cl^- < Br^-, NO_3^- < I^- < CNS^-$$

The comparative effectiveness of anions to induce volume contractions of solutions, which is a phenomenon caused by hydration of ions, was as follows:

$$CO_3^{--} > Fe(CN)_6^{-IV} > F^- > SO_4^{--} > H_2PO_4^- > Cl^- > I^- > Fe(CN)_6^{-III} > CNS^-$$

After comparing the two series, the authors predicted that $K_4Fe(CN)_6$ would be ineffective in making meat set, whereas $K_3Fe(CN)_6$ would be very effective. This prediction was later experimentally verified.

The authors concluded from their work that the setting phenomenon occurs when muscle proteins are strongly hydrated as the result of the influence of anions.

2.00 (Cross References: 1.95, 7.81, 4.61)

A study is in progress to determine if the bacteria in ordinary meats are able to break down lecithin and choline or any trimethylamine oxide present to trimethylamine as the bacteria in whalemeat are capable of doing.

Food Investigation Special Report No. 58, entitled "Whalemeat: Production and Preservation", and No. 59, entitled "Whalemeat: Bacteriology and Hygiene", present in detail the recent Low Temperature Research Station findings on whalemeat.

0.33 (Cross Reference: 3.5)

4.15

Sample 2 contained 39.9 percent saturated acids (palmitic, 23.6 percent; stearic, 14.5 percent; and myristic, 1.5 percent, together with a small amount of arachidic) and 60.1 percent of unsaturated acids (mainly C_{16}, 10.9 percent; C_{18}, 23.3 percent; and C_{20} and longer, 25.7 percent. C_{14} acids were also present.).

The only two other analyses previously reported of oils from Tsujimoto's fourth group were on oils from the shark, Carcharias gangeticus. As Galeocerdo rayneri is from the same family, Caracharhinidae, the authors suggest that the peculiar composition of the oils reported on here is characteristic of this particular family of fish.

Lovern has pointed out that in eels and tuna, there is a tendency toward the deposition of less unsaturated fat when the environment of the animal is at a relatively high temperature. As the present liver oils came from fish found in warm, almost equatorial waters, the relatively saturated nature of the oils may be explained by this tendency. Other explanations, however, may be possible. More work will be required to elucidate them.

3.5 ANALYSES OF BRITISH COLUMBIA SALT HERRING

Schmidt, P. J. (Pacific Fisheries Experimental Station, Vancouver, B. C.)
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 92, 3-5 (October, 1952)

To follow the progressive changes in the salt and moisture content of herring during salting, some 18 tons of fish caught on December 8, 1951 were commercially dry-salted at a plant in Steveston, B. C. Each day until the seventh day thereafter, a sample consisting of 25 fish was withdrawn at random from the tank. Additional samples were drawn on the 10th, 11th, 12th, and 13th days from a portion of the original 18-ton lot. Analyses of the samples appear in Table I (this card, over). The findings show a somewhat erratic variation in the moisture and salt contents from day to day that cannot be explained by the variations in fat content or size of the fish.

Even after 7 days of salting, some of the herring appeared to be insufficiently cured. The eyes and gills of these particular fish were red in color and the flesh was lacking in firmness. When a selected sample of the apparently inferior salted herring was analyzed and compared with a representative sample from the same lot (Table II), the inferior fish showed both a lower salt and a lower moisture content. It would appear, therefore, that salt herring quality cannot be judged on the basis of chemical analysis alone.

For comparison, a 20-pound lot of fresh herring from the same December 8 catch was salted in 100° salinometer brine. Samples consisting of 25 fish were drawn after 3 and 6 days in the brine. Analyses of these samples (Table III, omitted) showed that a relatively small quantity of herring in an excess of saturated brine will reach a degree of salting in 3 days that would ordinarily require 6 days of commercial salting. The analytical data presented in Tables I and II indicate that salting may not always be uniform. Actually, some

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3.230 THE FREEZING AND COLD STORAGE OF HERRINGS

Banks, A.
Food Investigation Special Report No. 55, Department of Scientific and Industrial Research, London, 40 pp. (1952)

The prosperity of the herring industry now depends mainly on home demand, which is for herring and kippers, and not for salted herring. This demand depends partly on supplies of other foods, but any large increase in it will probably be brought about by improving quality, and maintaining continuity of supply by suitable methods of preservation. Herring chilled with ice remain in fresh condition for only 30 to 40 hours, and for this require more ice than is usually employed. Frozen herring stored at low temperatures can be kept much longer, and can be made into kippers of fresh quality at any time. Experiments show that British-caught herring keep without change in flavour for 3 months at -20°C., and for 6 to 9 months at -30°C., if well glazed with ice; this protects the fish from atmospheric oxygen, which otherwise causes development of rancidity in the fat, assisted by a prooxidant in the flesh. Canadian experiments show that rancidity may also be prevented by storing in carbon dioxide or nitrogen, but the oxygen tension must be kept lower than is likely to be commercially possible. Other experiments in Canada and in the United States have shown that rancidity in fish may be prevented to some extent by anti-oxidants, but these have not yet been successfully applied to herring. To obtain the best results with frozen herring, freezing should be rapid enough to lower the temperature at the backbone from 0° to -5°C. in less than 2 hours; slower freezing does not give a texture suitable for kippering, and this is also lost during storage at temperatures much above -20°C., or at -20°C. after 8 to 12 weeks. Damage to the tails of frozen herring must also be avoided if the fish are to be kippered successfully on a commercial scale; this is best done by freezing the herring in 7-lb. packages, with the

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(The above abstract appears in Food Science Abstracts 24, No. 6, 517, November, 1952 and is reprinted here)

3.7 THE DRYING OF FISH

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 9 (1952)

The temperature of the air is the most important variable in the slow drying of raw herring fillets and other types of raw fish. This fact is borne out by the minor effect that any change in relative humidity and air velocity have upon the rate of drying. The limiting factor in the drying of raw fish therefore appears to be a very slow rate of diffusion of moisture from the interior of the fillet to the surface. Cod fillets of uniform thickness and cooked minced fish yielded drying curves that were almost exponential in form.

When unsalted cod or other similar species are dried in air, a product known as "stockfish" can be made. This form of dried fish is very popular in Nigeria. Attempts to prepare stockfish in artificial dryers at Torry Station have been successful. It is believed that an acceptable stockfish could be made even by drying in the open air. Similarly, a product resembling the hot-smoked and partially-dried shad of the Gold Coast, has been made from herring of low fat content. Dehydrated, minced, cooked fish, particularly herring, as well as both of the foregoing products, received a favorable response when tried in the British Colonies.

3.0 FISH PRESERVATION DOWN THE AGES

Cutting, C. L. (Department of Scientific and Industrial Research, Torry Research Station, Aberdeen)
Chemistry and Industry No. 46, 1110-1115 (November 15, 1952)

Fish and shellfish served as one of the major sources of food for primitive man. The earliest prehistoric method of preserving the day-to-day and seasonal surplus probably consisted of drying in the sun and wind. With the discovery of fire, cooking and artificial drying by exposure to the heat and the smoke of burning wood came into existence. Evidence exists to show that fish were consumed considerable distances inland by the Paleolithic cave-dwellers of France.

Fishing undoubtedly played an important part in the Bronze Age river civilizations. In Egypt, salting and sun drying were used for preserving fish after splitting and cleaning. By the sixth century, fishing had become an important occupation in the Greek Archipelago and the colonies from Sicily to the Bosphorus. Salt lakes and deposits were being worked in Egypt and Asia Minor about the same time.

Salted fish was even more common to the Romans than it had been to the Greeks and came to Rome from all over the Mediterranean and from the Black Sea. Red mullet, bream, swordfish, mackerel, tuna and sea-eel were among the fish cut into pieces and salted. Spices and odoriferous herbs as flavoring were used along with the brine. Salt apparently was produced on the east coast of Great Britain by artificial heat in the early Iron Age, even before the Roman invasion.

The sea fisheries of Western Europe were exploited in early feudal times and a sizeable trade had been established before the Norman Conquest. Combinations of drying, salting, and smoking were used to preserve most of these fish. The herring fisheries were

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QUALITY OF SALT HERRING

FISH DRYING IN GREAT BRITAIN

FREEZING AND COLD STORAGE OF HERRING

HISTORY OF FISH PRESERVATION

3.0 (Cross Reference: 1.01)

developed early in the Baltic by the Hanseatic merchants and in the North Sea by the Dutch, French, English, and Scots. Eviscerating the herring and packing them in barrels with salt was introduced by the Dutch. Toward the end of the fourteenth century a Dutchman, William Beukels, developed an improved method of salting herring that consisted of packing them in tight barrels and covering them with brine while at sea.

The majority of white fish taken were either dried to produce stockfish, brined in barrels like herring, or split, salted, and dried under various names. The first Norfolk vessels fished Icelandic waters in 1411 and the industry developed rapidly. The fish taken consisted mainly of cod, caught by hook and line and salted at sea. In 1497 Newfoundland with its rich fishing grounds was discovered. The best large grained salt obtained by slow crystallization and most suitable for fish curing was imported from Rochelle and other ports along the Bay of Biscay.

The men of Brixham seem to have been mainly responsible for the development and spread of trawling with Barks in the English Channel and eventually in the North Sea and Irish Sea in the early part of the nineteenth century. A Barking firm, in the 1850's, was the first to introduce the collection and storage of ice for improved preservation of fish. The first successful steam trawlers were launched in 1882. They caught four times as much fish, and eventually the North Sea fleets were converted to steam. After World War I the emphasis in fishing switched to more distant trawling grounds off Iceland, the White Sea, even Greenland, and eventually the Bear Island grounds. As a result, landings of white fish, particularly cod, increased phenomenally. The steam drifters, first built in 1897, not only doubled the catch of the old sailing vessels but also improved the average quality of fish landed.

With the advent of the railways, hard and heavily salted smoked herring such as "reds" gave way to milder smoked cures like "Yarmouth Bloaters". Canning came into existence between 1795 and 1810 and was soon applied to fish. The first salmon was canned at Aberdeen in 1824 and in Nova Scotia in 1840. Salmon canning on the Pacific coast of the U. S. A. dates back to the Civil War and in Alaska to 1878.

3.5 (Cross Reference: 1.2)

of the fish may become sufficiently salted in 4 days whereas others may require 6 days. The limiting factor in the dry-salting process therefore appears to be the amount and the concentration of the brine surrounding the individual fish. Stirring the fish in the tank would overcome the lack of uniformity in the brine concentration, but the salting tanks are not suited to this purpose. Salting in a continuously circulating saturated brine has been tried on a large scale with good results, according to issue No. 86 of the Progress Reports.

TABLE II.—Comparative analyses of apparently poorly salted herring and of a representative sample of herring, after 7 days in tank.

Sample	Av. wt. of individual fish (ounces)	Moisture content (%)	Salt content (%)	Fat content (%)	Results expressed on a dry, salt-free basis		
					Moisture (%)	Salt (%)	Fat (%)
Inferior	3.41	49.3	10.7	17.3	123.1	26.7	43.2
Representative	2.94	50.2	12.4	16.0	134.2	33.2	42.8

TABLE I.—Analysis of samples of 25 herring taken daily during salting process.

Days of salting	Av. wt. of individual fish (ounces)	Moisture content (%)	Salt content (%)	Fat content (%)	Results expressed on a dry, salt-free basis		
					Moisture (%)	Salt (%)	Fat (%)
0	3.4	66.9	0.48	15.1	205.0	1.47	46.3
1	3.0	62.8	3.01	15.3	183.5	8.80	44.7
2	3.1	59.1	5.26	13.2	166.0	14.8	37.1
3	3.1	55.0	6.60	13.9	143.2	17.2	36.2
4	3.1	53.9	8.78	11.9	144.5	23.6	31.9
5	3.1	51.6	9.26	15.8	131.9	23.7	40.4
6	2.6	51.4	11.7	14.4	139.4	31.9	39.0
7	3.3	50.8	11.2	16.2	133.7	29.5	42.7
10	3.0	50.5	12.2	16.3	135.3	32.7	43.7
11	2.8	51.3	12.8	15.4	142.9	35.6	42.8
12	3.0	52.5	13.9	13.9	156.2	41.4	41.4
13	3.1	50.9	14.5	16.4	147.2	41.9	47.4

3.230 (Cross Reference: 1.2)

tails in the centre of the block. Both multi-plate and air-blast methods of freezing were satisfactory. Drying during cold storage tends to affect the herring at the outside of the block, and to increase the rancidity of their fat. Improvement of cold storage conditions may reduce this; under existing conditions, it is best to glaze the packages with ice, and then wrap them in moistureproof material, the best so far tested being aluminum foil. Herring thus stored stand up reasonably well to the normal methods of smoke-curing. Kippering of fresh herring and freezing the kippers has some advantages over the freezing of herring as a procedure for spreading out seasonal supplies. The freezing plant can be simpler because rapid freezing is not essential, and less power is required because the weight of kippers is less than that of a corresponding supply of herring. Kippers can be kept in first-class condition for 5 months at -30°C. and for 2 1/2 months at -20°C. On the other hand, the freezing of herring followed by kippering yields a superior product, and the kippering of large amounts of herring for cold storage would strain existing resources; the kippering of frozen herring during the off-season would make use of idle plant and labour. On balance, freezing herring is considered preferable to freezing kippers.

7.641 CHROMATOGRAPHIC SEPARATION AND MICROBIOLOGICAL ASSAY OF INDIGENOUS AND ADDED COBALAMINS IN CRUDE ANIMAL PROTEIN MATERIALS

Tarr, H. L. A. (Pacific Fisheries Experimental Station, Vancouver, B. C.)
Canadian Journal of Technology 30, Nos. 10 and 11, 265-279 (October-November, 1952)

The objects of this work were to establish conditions under which identical microbiological assay results could be obtained with cyano- and hydroxo-cobalamins, to determine how much of the total cobalamin content of certain crude animal protein materials could be recovered after concentration by chromatographic separation using filter paper technique, and to ascertain the stability of added cobalamins during the autoclaving procedure used in releasing the indigenous cobalamins present in the natural materials.

Details of the assay which gave identical response of the organism to both cyano- and hydroxo-cobalamin are given. In the medium used, cyano-cobalamin is much more unstable than hydroxo-cobalamin, and in several experiments it was found that the former is inactivated much more rapidly than the latter in the uninoculated assay medium in the presence of added reducing agent.

Chromatographic separation of aqueous extracts of herring meal showed much more pronounced growth zones corresponding to hydroxo-cobalamin than to cyano-cobalamin. In samples heated in the presence of mercaptosuccinic acid large growth zones developed that were slightly farther from the point of application than those occupied by hydroxo-cobalamin. This indicated the formation of a mercaptosuccinic acid adduct of vitamin B_{12}. Satisfactory recovery of added cyano- and hydroxo-cobalamins from the autoclaved water suspensions of the fish meal indicated that the heating did not cause any serious destruction of the vitamins.

Autoclaving crystalline cyano-cobalamin in the culture medium in the presence of mercaptosuccinic acid resulted in a much higher response than that from its aseptic addition under identical conditions. The much lower and apparently more normal recoveries found when the cobalamin was separated chromatographically and assayed indicated that the mercaptosuccinic acid adduct which is formed may be unstable.

The effect of cyanide on the recovery of indigenous and of added cobalamins in fish

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 ABSTRACTER: Neva L. Karrick

7.641 THE VITAMIN B_{12} ACTIVITY OF NATURAL MATERIAL WITH PARTICULAR REFERENCE TO COD LIVER PROTEIN

Guttman, A. and Vandenheuvel, F. A. (Atlantic Fisheries Experimental Station, Halifax, N.S.)
Journal of the Fisheries Research Board of Canada IX, No. 3, 129-140 (September, 1952)

In a study of the variations in vitamin B_{12} activity of cod liver residue under the influence of heat over a wide range of pH values, it was found that the method of extraction of the sample for assay was responsible for abnormal results. Most of the work in the present paper is a description of extraction techniques studied.

For the microbiological assay Lactobacillus leichmannii A.T.C.C. 4797 was used. The culture was subcultured in broth stock medium plus 1.5 g. per 100 ml. of cod liver extract.

The effect of alkali and heat treatment on cod liver residue was tested. The alkali-labile activity of liver between 60° and 80°C. is more stable than crystalline vitamin B_{12} under the same pH conditions. For both materials, destruction occurs readily at 100°C. over the whole range and is complete at pH 12. Steaming the cod liver at pH 5 to 9 does not result in a decrease in vitamin B_{12} activity over a period of one hour.

Extraction of cod liver residue with pepsin and papain at pH 5 and pancreatin at pH 7.2 was studied. Pepsin or papain had no effect and a decrease in activity resulted from pancreatin.

Three samples of cod liver residue were mixed with 0.1 percent of their weight of ascorbic acid, sodium thiosulfate and sodium bisulfite, respectively. Treatment with ascorbic acid was detrimental, sodium thiosulfate resulted in an increase in activity, but bisulfite resulted in a large increase.

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 ABSTRACTER: Neva L. Karrick

7.6132 REPORT ON VITAMIN A IN MIXED FEEDS

Cooley, Maxwell, L. (General Mills, Inc., Minneapolis, Minnesota)
Journal of the Association of Official Agricultural Chemists 35, No. 3, 706-715 (August 15, 1952)

The importance and general use of true vitamin A in animal nutrition have increased efforts to perfect a suitable chemical procedure for the measurement of this vitamin in mixed feed. In 1949 the A.O.A.C. instigated a collaborative study on vitamin A in mixed feeds. The work was continued in 1950, and following the report and recommendations of the Associate Referee, the method was adopted first action. Details of the procedure used for the collaboration are given briefly as follows:

Weigh 10 g of feed directly into a fat extraction or refluxing flask. Weigh approximately 1 g of dehydrated alfalfa meal into the same flask. This serves as a source of beta carotene which facilitates locating by visual examination the carotene band in the chromatogram. Add exactly 100 ml of hexane and reflux for 30 minutes. Remove refluxing flask, cover, cool, and allow to settle. Draw a 50 ml aliquot of the supernatant liquid through a magnesia-Super Cel adsorption column under suction. Elute with enough 10% acetone in hexane to bring the beta carotene band to the bottom of the column and just begin to elute this pigment. The colorless vitamin A band precedes the beta carotene band, and elution of some of the latter band indicates complete elution of vitamin A. Evaporate the solvent from a suitable aliquot of the eluate, under reduced pressure and mild heat, and take residue up in chloroform. The Carr-Price reaction is applied in a spectrophotometer or colorimeter tube; the antimony trichloride reagent is added rapidly to the solution of vitamin A in chloroform, and the maximum blue color is read at 620 mμ. Readings are referred to a standard curve established with the U.S.P. Vitamin A Reference Standard.

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7.80 FREEZING BRITISH COLUMBIA FISH AT SEA. II.

Lantz, A. W. (Pacific Fisheries Experimental Station, Vancouver, B. C.)
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 92, 21-22 (October, 1952)

During the past year, taste panel comparisons have been made of halibut, brill, and rock sole stored in ice versus frozen at sea. The panel was composed of over 200 Vancouver citizens.

In three recent taste tests, about 42 percent of the panel members expressed a consistent preference for halibut landed in ice 3 to 5 days after catching, frozen on shore, and stored at -15°F.; about 31 percent preferred the halibut frozen at sea and held in frozen storage at -15°F. on shore. The remaining 27 percent of the group expressed no preference. Earlier taste tests have indicated a marked preference for frozen halibut over iced halibut when the latter was held on ice at 32°F. for as long as 18 days. The halibut that was air-blast frozen at sea aboard the Tauranga, however, appeared to be firmer in texture and less moist than halibut held on ice.

In taste tests conducted with flatfishes such as brill and rock sole, 45 percent of the panel members preferred the samples frozen at sea, whereas 35 percent preferred the samples that had been iced at sea and frozen ashore. The remaining 20 percent did not express any preference. The same tasters also showed a preference for flatfish dressed prior to washing in sea water and stored in ice in the hold as opposed to flatfish washed, stored in ice, and dressed after landing on shore. Specifically, 37.2 percent preferred the dressed-at-sea flatfish, whereas 28.1 percent preferred the flatfish dressed after landing. The remaining 34.7 percent were unable to distinguish between the two.

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 ABSTRACTER: Martin Heerdt

SEPARATION AND ASSAY OF COBALAMINS

MEASUREMENT OF VITAMIN A IN MIXED FEED

EFFECT OF EXTRACTION METHOD ON B_{12} ACTIVITY

QUALITY OF FISH FROZEN AT SEA

7.6132

The 1951 collaborative study of the procedure demonstrated an improvement in application of the method compared with previous studies. The feed samples used in the recent work had vitamin A potencies within a more practical range. The samples included two sets of duplicates, and results on these indicate that assays of replicate samples were in reasonably close agreement. The method is more accurate for higher potency feed samples (15 or more units of vitamin A per gram) than it is for lower potency feeds (4 or less units of vitamin A per gram), because the ratio of vitamin A content to interfering materials is greater. However, collaborative data on lower potency feed samples showed that three-fourths of the laboratories obtained results which were within ± 20 percent of the mean, and the mean was practically the same as the theoretical potency of the feed. Indications are that the method should be acceptable for the measurement of the vitamin A content of mixed feeds within the limits of accuracy expected for this type of vitamin assay.

The Associate Referee recommends the status of the method be continued first action subject to further collaborative studies.

7.80 (Cross References: 2.19, 3.230)

Taste tests were also made to determine if dressing tuna prior to freezing had any effect on the quality of the canned pack. Albacore tuna taken off the Oregon coast by the Tauranga were dressed by removing the gills and viserca immediately after capture. The fish were then chilled by packing in refrigerated ice and frozen by contact with the aluminum walls of the refrigerated jacket in the hold of the vessel. Upon arrival on shore they were placed in frozen storage until they could be canned.

A British Columbia pack of commercially canned albacore tuna taken in the same general area during the same period by a refrigerated tuna boat was used for comparison. The commercial pack, however, was prepared from tuna that had been chilled, and frozen in the round aboard the vessel and held in frozen storage on shore before being dressed for canning. Of 158 persons participating, 54 percent preferred the dressed-at-sea pack, whereas 33 percent preferred the dressed-prior-to-canning pack. The remaining 13 percent did not have a preference.

7.641 (Cross Reference: 5.41)

meal and its influence on the ratio of hydroxo- to cyano-cobalamin in the treated meal was investigated. Cyanide treatment had no important effect on the results found by direct microbiological assay, and good recoveries of added cobalamins were obtained. The cyanide did not cause complete conversion of the hydroxo-cobalamin to the cyano form in crude products.

The total cobalamin content of both chum and sockeye salmon kidney was higher than that of beef liver. However, after chromatographic separation, 91, 71, and 55 percent, respectively, of the amount indicated by direct assay was recovered. It has been shown that practically all of the vitamin B_{12} activity of certain crude animal protein products, including fish meal, is destroyed by treatment with alkali, and with these materials less than 8 percent of the total activity was accounted for by deoxypentosides.

VITAMIN B_{12} CONTENT OF SALMON KIDNEY AND BEEF LIVER AS DETERMINED BY DIRECT ASSAY AND ASSAY AFTER CHROMATOGRAPHIC SEPARATION

Product assayed and amount of suspension chromatographed***	Mμgm. of vitamin B_{12}-activity per gm.						
	Direct assay of extracts			Chromatographic separation, elution and assay			
	(1)*	(2)*	Av.	(1)	(2)	Av.	% Recovery**
Chum salmon kidney (0.02 ml. 1:4 suspension)	2230	1990	2110	2000	1844	1922	91
Sockeye salmon kidney (0.02 ml. 1:10 suspension)	3760	3567	3664	2580	2440	2510	69
" " " " (raw) (0.02 ml. 1:10 suspension)				2760	2670	2715	72
Beef liver (0.05 ml. 1:2 suspension)	1620	1539	1580	900	972	936	59
" " (0.02 " 1:2 ")				890	760	825	50
" " (0.02 " 1:1 ")				874			55
7.6 mμgm. of vitamin B_{12}				7.26 mμgm. recovered = 95%			
5.0 " " " B_{12a}				4.90 " " = 98%			

*Assay values under (1) obtained on the day of preparation and under (2) after five days at 0°C.
**Per cent of the value found by direct assay. The figure in this column for the raw salmon kidney is based on the direct assay of the heated extract. This indicates extraction was complete and the vitamin was not destroyed by heating.
***All suspensions autoclaved for five minutes at 120°C. with the exception of the one sample of sockeye salmon kidney.

7.641 (Cross Reference: 6.233)

In order to show that the influence of bisulfite was not due to a growth-promoting action, standard curves were duplicated with and without addition of bisulfite to the basal medium. The same growth level occurred in all pairs of tubes and the curves were identical. A standard solution of vitamin B_{12} of 0.5μg. per liter was subjected to various heat treatments with and without bisulfite. No significant change was observed except on autoclaving in the absence of buffer, when complete destruction occurred. The protective action of the buffer explains why no drastic decrease in activity occurs when samples of natural materials are autoclaved in the presence of bisulfite.

Highest results were obtained when the samples were autoclaved at 5 pounds pressure and pH 5.5 for 5 minutes in the presence of bisulfite. Bisulfite had very little effect when used with air dried material. However, when it was added prior to drying, the dry material obtained still led to the same increased values, even after several months of storage.

The alkali-digestion process (pH $>$10, 100°) was very destructive but the conditions in the new rendering process (pH $\leq$ 8.5, 60°) did not appear detrimental. However, even under the most drastic conditions about 10 percent of the total initial activity remained unaffected.

Low results for a sample may be due to any of the following causes: (1) A variable binding of the factors to the protein substrate. (2) A change of the factors into forms inactive on L. leichmannii. (3) A change into forms subsequently destroyed under the analytical conditions.

The effects of sodium bisulfite and ascorbic acid on vitamin B_{12} activity were compared. Ascorbic acid in water was very detrimental, but in the presence of the assay medium a large increase resulted. Sodium bisulfite and water gave in general an even larger increase but the presence of medium did not have a beneficial effect. The authors concluded that the large increase resulting from autoclaving in the presence of medium containing 0.02 percent ascorbic acid was due to the protection of B_{12a} and/or B_{12b}. The effect of sodium bisulfite could be partly due to a similar property, but an additional effect may be involved and the mechanism may be different. The authors suggest that the additional action of the bisulfite may be due to a release-promoting action of factors from the substrate or an additional protective effect not offered by ascorbic acid plus medium, possibly on a factor different from B_{12a} and/or B_{12b}.

0.12 HERRING PROCESSING MACHINERY

Anonymous
Food Science Abstracts 24, No. 6, 526 (November, 1952)

The following references are cited.

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Ideas on the Use of the Fish Scaling Machine in the Industry and in the Wholesale Trade. Hermann, C. Fischw.-u. Feinkostind 23, 40 (1951). The advantages accruing to the fish industry from the introduction of German scaling machinery (made by Nordischer Maschinenbau, Lubeck) are enumerated.

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3.23 A STAKE IN STEAKS

Anonymous
Pacific Fisherman 50, No. 12, 63-69 (November, 1952)

A large national company has equipped a special section of its Everett, Washington plant for the exclusive production of salmon and halibut steaks.

With machinery designed and developed by the company's own technical men, the steaks are knife-sliced from unfrozen salmon and halibut, brined, portioned, inspected, packaged wrapped and frozen in a specialized production line. The steaks are cut 7/8 inch thick; the carton is the same depth, 8 5/8 inches long, and 3 3/4 inches wide. Each carton contains exactly one pound. Halibut steaks are usually packed three portions to the pound. Salmon steaks run from two to three pieces, averaging two-and-a-half.

Although steaks have been sawed from frozen salmon and halibut for many years, there have always been certain packaging problems involved, such as the necessity for random weights and the lack of compactness in the package.

An advocate of plate freezing under controlled pressure for packaged fish products, the company decided its steaks should be knife-sliced from unfrozen halibut and salmon to permit them to be packaged and frozen in this manner.

Advantages claimed for this procedure include:

(1) The knife cut is smooth, leaving a glossy surface.
(2) Exact weight can be put in the carton, with resulting uniform price per package and elimination of time and trouble demand on the retailer in weighing and/or pricing each individual package.

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 ABSTRACTER: Roy C. Stevens

6.52 POTENTIAL MARKETS FOR ALASKA SALMON CANNERY WASTE

Wigutoff, Norman B. (Fishery Marketing Specialist, U. S. Fish and Wildlife Service)
Commercial Fisheries Review 14, No. 8, 5-12 (August, 1952)

The Alaska salmon canning industry each year discards between 100,000,000 and 125,000,000 pounds of salmon waste. Besides the fact that this material, ordinarily discharged into the bays, presents a health hazard, it is an economic waste. Reduction plants cannot provide the solution because they are unable to operate profitably in isolated areas where only one or two canneries are located. Therefore, the U. S. Fish and Wildlife Service and the Alaska Fisheries Experimental Commission have made a study of the economic possibilities for the use of this salmon waste.

Research has shown salmon waste, particularly the soft visceral portions, to be an excellent source of protein and vitamins. The greatest potential market for the material appears to be in the fur-farm and fish-hatchery industries. Accordingly, in the summer of 1951, a survey was made in 17 Western and Midwestern states to determine the extent of such a market.

In the Pacific Northwest it is common practice to use about 60 percent fish in mink diets, whereas in the Midwestern states 15 to 20 percent fish in mink diets is considered high. If mink can be raised successfully in the Northwest on a large proportion of fish in the diet, it seems logical to assume that the same proportion of fish might be used for mink elsewhere. The following table shows the potential market for fish for mink feed in the 17 states covered by the survey.

Table 2 - Mink Feed Requirements in 17 States

	lbs.
Annual average number of mink on farms in 17 States	2,198,000
Total annual mink-feed requirements at 100 lbs. per animal	219,896,000
Potential fish requirements based on 60 percent fish in diets	131,934,000
Potential fish requirements based on 15 percent fish in diets	32,984,000

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 ABSTRACTER: Roy C. Stevens

9.16 POND AND LAKE BREEDING OF FISH -- A WORLD SURVEY

Hardy, Eric
World Fishing 1, No. 8, 300-303 (November, 1952)

Pond and lake cultivation of fish is increasing throughout the world, particularly in those countries in which there is an acute shortage of protein foods.

Russia has established four fish-breeding stations on Kuibyshev Lake, and five above Stalingrad. Fish are reared at these stations for introduction into suitable waters, chiefly as eggs and fry. The fish being used for these introductions and breeding experiments are said to include six varieties of salmon, two species of trout, and sturgeon.

Israel's annual consumption of fish amounts to 22,000 tons. Of this amount 16,000 tons is imported, 4,000 tons is obtained from the carp-breeding ponds, 1,000 tons is taken from the sea, and 1,000 tons in the form of lake fish from Galilee and Huleh. The carp-breeding ponds have probably reached the limit of their capacity because they compete with agriculture for land and water. However, the country's climate has proved very suitable for a rapid growth of carp, and it has been possible to obtain two-and-a-half fish harvests a year. It is hoped to extend pond culture to rainbow trout, tench, and grey mullet. It is also intended to introduce new, fast-growing species into Lake Tiberias, to establish additional hatcheries, and to fertilize the lakes in order to obtain greater production.

The Chinese have had extensive pond fish culture since 2,000 B.C., but their methods have shown little change. The chief species cultivated are the common carp, oriental perch, and species of Hypophthalmichthys. They also raise daphnia for fish feed.

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 ABSTRACTER: Roy C. Stevens

HERRING PROCESSING MACHINERY

MARKETS FOR ALASKA SALMON CANNERY WASTE

SALMON AND HALIBUT STEAKS

WORLD SURVEY OF FISH CULTURE

6.52 (Cross Reference: 6.51)

In a 1949 survey it was reported that a total of over 29,000,000 pounds of food was used by fish hatcheries of 38 states and the Federal Government. Privately-operated hatcheries were not included in that study. Supervisors of the U. S. Fish and Wildlife Service hatchery operations in Region 1, comprising the states of Washington, Oregon, California, Idaho, Montana, and Nevada, report annual requirements of salmon viscera alone at 1,000,000 to 1,500,000 pounds. Fish comprise 75 to 90 percent of the foods used in the state-operated hatcheries of Oregon and Washington.

During the summer of 1951 over 100,000 pounds of frozen salmon viscera were collected at Petersburg, Alaska, for use in a Federal hatchery in the state of Washington. The costs of the collection and shipment to Seattle are given in the following table.

Table 4 - Cost for Collecting and Shipping 100,750 Pounds of Salmon Viscera from Petersburg, Alaska, to Seattle, Washington

Cost f.o.b. dock at Petersburg, Alaska[1]	$3,084.00
Freight, wharfage, and handling charges Petersburg, Alaska, to Seattle, Washington	$2,167.39
Price per pound f.o.b. dock, Petersburg, Alaska[1]	3.06¢
Shipping cost per pound--Petersburg, Alaska, to Seattle, Washington (includes wharfage and handling both places)	2.15¢
Price per pound f.o.b. dock, Seattle, Washington	5.21¢

1/ INCLUDES LABOR AND MATERIALS FOR COLLECTION OF WASTE, INSTALLATION OF COLLECTION FACILITIES, HAULING TO COLD STORAGE, FREEZING CHARGES, AND COST OF VISCERA AT 2¢ PER POUND, BUT DOES NOT INCLUDE THE PACKER'S PROFIT ON THIS OVER-ALL COLLECTION.

When the prices now paid by mink ranchers and fish-hatchery operators for other feeds are compared with the cost of Alaska salmon-cannery waste, it is apparent that the latter cannot now profitably enter the market. However, should a shortage of other feed materials develop, should the entire waste be used instead of only the viscera, or if lower freight rates from Alaska can be obtained, the situation could easily be altered.

9.16

The present Hungarian pond yield of carp is about 2,500 tons. The shallow ponds range from a few hundred yards to a mile or more in length. During the summer the fish feed on plankton and other natural foods, and during the winter and spring they are artificially fed. In November the large waters are drained, the marketable fish removed, and the young and breeding fish separated and put into smaller winter stock-ponds.

The Italians have established the largest eel farms in the world, with a catch of 500,000 kg. or more annually. Most of this is marinated down with spiced vinegar and exported. The "farms" actually consist of large traps used to catch the migrating eels.

Holland and Denmark have both established sizable export markets for rainbow trout. Denmark alone has exports valued at some 2 million kroner.

The giant carp or Catla of India is of great value because of the great size that it attains and the rapidity with which it grows. Under ideal conditions, Catla carp have grown from fry to a length of 26 to 29 inches and a weight of 6 to 9 pounds in the first year. Full grown, these fish will reach a length of more than 6 feet and a weight of 140 pounds.

In Malaya, a supply of freshwater fish has been built up by transporting Chinese carp fry by air and establishing them in farm ponds.

The United States has over 300,000 farm and ranch fish ponds with an area of 360,000 acres and a potential yield of 18,000,000 pounds of edible fish a year. Fertilization of lakes and ponds has been practiced extensively to increase fish production.

0.12 (Cross References: 1.2, 3.0)

On Washing, Slime Removal, and Scaling of Herring. Biegler, P. Fischw.-u. Feinkostind 23, 59 (1951). The operational principle of a herring washing machine, designed and constructed by Nordischer Maschinenbau, Lubeck, is described.

3.23 (Cross References: 1.30, 1.61)

(3) As they are put under pressure in freezing, the steaks fill the package completely, all air being expelled, with resultant protection of color and flavor.
(4) Economic recovery is greater, largely through elimination of the saw kerf.
(5) The process lends itself to automatic operation, with the cartons being formed and closed mechanically.

The cutting machines consist essentially of a revolving circular knife with a carriage on which the fish is held firmly as it advances against the knife, and on which it may be moved a precisely determined distance for each succeeding slice. Halibut and salmon carriages differ in design, but are interchangeable. The halibut carriage is broad and flat with a stainless steel clamping band to hold the fish securely. After each cut the clamping band relaxes automatically. Moving the fish against the guide, the operator steps on the control of a hydraulic cylinder that tightens the clamp and moves the carriage forward, taking the fish through the knife. The carriage returns automatically, relaxing the clamp for the next slice. The carriage used for salmon is much smaller and lighter. It has a different type of clamp and is operated manually.

An automatic, stainless steel brining device provides precise control of salting. Carried to the portioning station, the larger halibut are divided into portions suitable for packing in the cartons; the salmon are trimmed and any fins removed. After careful inspection the steaks are carried to the carton filling table where they are packed attractively and to exact weight in one-pound cartons. Passing through the carton-closing machine the wrapped cartons are placed two-deep in aluminum freezer trays. They are then transferred to a plate freezer operated at a plate temperature of minus 55°F., with a plate pressure on the packages of 275 psi. The steak packages are frozen to 0°F. in 65 minutes; and to minus 20° in 80 minutes, when they are removed, packaged in corrugated fiber cartons, 12 and 24 pounds capacity and stored at minus 16°F.

0.12 FISH HANDLING AND PROCESSING IN U. K. -- EQUIPMENT

Empey, W. A. (C.S.I.R.O. Division of Food Preservation)
Fisheries Newsletter (Australia) 11, No. 11, 11 (November, 1952)

There have been marked developments in the mechanization of fish processing in Great Britain during the past twenty years, particularly in the newer industries such as quick freezing. Machines for heading and splitting cod before salting are used in many plants; however, there have been no commercial developments in the use of machines for filleting white fish although the quantity filleted amounts to approximately 400,000 tons annually. Satisfactory machines for the filleting of cod, haddock and similar species showing considerable variation in dimensions, and varying in softness, depending on the time after catching, have not yet been developed. However, fillet skinning machines capable of removing the skins of the above species at the rate of approximately thirty fillets per minute are in common use.

Herring gibbing and nobbing machines with a capacity of sixty fish per minute are employed throughout the industry. Another machine used for splitting herring down the back and removing the gut handles fifty fish a minute. Still another combines the operations of heading, gutting, cleaning, splitting, and removal of the backbone and attached rib bones at the rate of forty fish per minute.

Because of the high cost and scarcity of material, regulations have been introduced to bring about the use of returnable boxes for fish transport. A sturdy box with a specially designed lid that does away with the need for using nails has been developed. A spraying technique has also been adopted for applying a protective coating of formaldehyde and casein to the surfaces of the box. This is said to facilitate cleaning.

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 ABSTRACTER: Roy C. Stevens

3.5 FISH HANDLING AND PROCESSING IN U. K. -- SALT CURING

Empey, W. A. (C.S.I.R.O. Division of Food Preservation)
Fisheries Newsletter (Australia) 11, No. 11, 9 (November, 1952)

British production of salt cured herring and white fish species has declined steadily over the past 20 years. This has been due principally to the loss of overseas markets, and to a lesser extent to the changing food habits of the British consumers.

On reaching the packing plant, herring destined for salt curing are gutted and thrown into tubs or baskets according to size. They are then "roused" with a small quantity of fine salt so that each fish comes in contact with the salt. After shaking to remove surplus salt, the herring are packed in barrels, belly up, in tight rows. Each layer is sprinkled with salt before the next is added. The total amount of salt used amounts to approximately one-third the weight of the fish. After allowing one or two days to settle, the space left at the top of each barrel is filled with fish from the same day's pack and the barrel is headed and laid on its side. A bunghole is bored in the bilge of the barrel and saturated brine is poured in through a funnel to completely fill the barrel. The herring body oil thus brought to the surface is removed and the bunghole closed. During the period of maturation before export, the barrels are stored on their sides and rolled half-way around from time to time.

Cod and other white species for curing are first headed, split and thoroughly washed in fresh water. When they are salted on shore the fish are placed in tanks in layers, flesh side up, and salt scattered over each layer. Approximately 18 pounds of salt is used for each 100 pounds of split fish. After standing from 4 to 6 days the fish are removed from the salt and scrubbed in brine to remove any undissolved salt or other debris. They are then ready for drying.

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 ABSTRACTER: Roy C. Stevens

2.118 PACIFIC COAST FISH PROCESSING VESSELS

Nickum, G. C.
Transactions of the Society of Naval Architects and Marine Engineers 57, 139 (1949),
New York

Various Pacific coast factory ships, built between 1922 and 1939, are described. All were used for salmon canning in Alaskan waters. Between 1930 and 1940, large freighters, equipped with herring reduction plant, operated in the pilchard industry off the coast of California. After World War II, further developments took place. The "Pacific Explorer", completed in 1946, operated for several seasons in the Bering Sea and South American waters. The trawler "Deep Sea" was designed to catch and process fishery products of the Bering Sea. In 1947, two tank-landing ships (LST's), the "Saipan" and "Tinian", were converted for use as fish freezing and transport vessels in the tuna trade. Two net tenders and another LST, the "Oceanic 5", were converted and operated in Central American waters. Detailed plans are given showing how an LST was converted into a combined freezing and canning vessel (the "Neva", put into operation in 1950). All except the "Deep Sea" were converted boats. The "Deep Sea" is the only one which operates at sea for more than a few months every year. The short salmon season is one of the reasons for this. Tunny mother ships have usually made not more than 4 trips a year, and most of the time is spent at anchor, receiving or discharging fish. Fuel and other operating economies, made possible by modern machinery and specially designed types of hull, are of real advantage only when the vessel is moving. The use of fish processing vessels can be justified only if the net cost per ton of product is less than that when the fish are processed ashore. Adequate space is essential. Most processing vessels work as mother ships for a fleet of small boats. The problems of accommodation, storage, handling, stability and subdivision, U. S. Government regulations, hygiene, salmon canning, filleting, crab canning, the production of fish meal and fish oil,

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6.13 FISH HANDLING AND PROCESSING IN U. K. -- BY-PRODUCTS

Empey, W. A. (C.S.I.R.O. Division of Food Preservation)
Fisheries Newsletter (Australia) 11, No. 11, 9, 11 (November, 1952)

Most of the fish meal produced in Great Britain is obtained from the offal of white fish filleted at the ports of Hull and Grimsby. The present annual production of white fish meal is between 40,000 and 50,000 tons, and this is expected to increase with the discontinuance of the practice of heading the fish at sea. Only small quantities of meal are produced from oily fish such as herring and miscellaneous species of red fish.

The plants in operation are of conventional German design, employing vacuum heating and drying without pressing. Most factories include some small units that can be used either for vacuum heating and drying or operated in conjunction with a press in the case of oily fish where separation of oil is required. At one plant the stickwater was acidified, heated to precipitate solids, decanted and concentrated in falling film evaporators normally used for the manufacture of glue.

One company had a pilot plant for producing fish flour and fish albumen, but so far there has been no commercial production of these products.

A herring meal plant at Fraserburgh was of Norwegian design, with conventional steam cookers, screw press, rotary cylindrical flame drier, settling tank and centrifuges for separation of oil. The equipment was capable of handling 4 to 5 tons per hour.

Fish glue of various grades is produced on a small scale at Hull and Aberdeen from the skins of filleted and skinned white fish. Skins that have been salted for storage

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 ABSTRACTER: Roy C. Stevens

FISH PROCESSING EQUIPMENT

PACIFIC COAST FISH PROCESSING VESSELS

SALT CURED HERRING AND WHITE FISH

MANUFACTURE OF BY-PRODUCTS IN GREAT BRITAIN

2.118

mooring, electric power, ventilation and heating, and refrigeration are discussed, with descriptions of methods used on existing vessels. The refrigeration problems are dealt with in detail. Subjects discussed include: temperature conditions encountered in service; type of refrigeration equipment used; refrigerant piping; air-blast, contact and brine freezers; and types of insulation.

6.13

must be leached before processing.

The production of fish body oils from herring and other oily fish is comparatively small, but there is a substantial production of fish liver oils from cod, halibut, etc.

0.12 (Cross Reference: 2,3)

A Lowestoft firm packs its fish in aluminum alloy boxes with crushed ice throughout and on top of the fish. While in transport, the boxes are placed in insulated compartments lined with aluminum alloy and provided with drainage holes. These compartments have a capacity of three tons and have rails on which the fish boxes are placed. They are used both for truck and rail transportation.

3.5

When salted at sea, the fish are dry-salted in lockers in the sides of the vessels. Here more salt is required than when salting in tanks, in order to make sure that the exposed parts of the fish are properly cured. After about two weeks the fish are turned over and resalted.

By either of the above methods, the fish are brought to a salt content of about 18 percent. They are then hung on tenter hooks in drying kilns held at 60°F. In the final stages of drying, the temperature is raised to about 80°F. After about two days' continuous drying over the kiln grates, the fish are taken down and stacked in piles or "steeples" to sweat for about two weeks. They are then hung up to dry for a second period of about two days in the case of medium size cod. Larger fish are stacked again and weighted down before drying for another 24 hours. The final water content of the dried product ranges between 35 and 43 percent, depending upon market requirements.

2.0 FRESH STOCKFISH

Rowan, A. N.
Fishing Industry Research Institute (South Africa), 5th Annual Report (1952) 7-8

Observations were made on the various phases of handling and processing fresh fish.

One hundred fourteen stockfish were examined under ultraviolet light through Woods glass to detect the presence of Chloromyxum thyrsites, a protozoic parasite believed to break down the flesh of fish. Ninety-three of the samples showed less than 10 infected spots visible in filleted fish and 3 showed more than 50 infected spots. The average number of infected spots was 6 per fish. No detectable differences in storage qualities were found between infected and uninfected fish. A few of the infected spots, as detected by ultraviolet light, disappeared when the infected fish were kept in ice for a few days. Infected flesh dipped in water for 5 minutes at 120°F. and lower showed 70% of the original spots after 2 days in ice; those dipped at 140°F. and 160°F. showed only 20% of the original spots; the fluorescence became more diffuse after storage in all samples.

"About 60% of the fish were in rigor mortis within the first half hour after landing on deck, 85% in the first hour, and all within 2 1/2 hours. Icing delayed the onset of rigor only very slightly."

The odor of the freshly caught stockfish is seaweedy; it becomes neutral after a few hours, "fishy" after 5 to 6 days, "off" after about 10 days, and ammoniacal and putrid after 15 days. Fresh stockfish have a pearlescent sheen that disappears after 5 to 6 hours; the color becomes dull after 5 to 6 days; a yellowish tinge develops after 10 to 12 days; and the color darkens slightly on storage.

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 ABSTRACTER: D. T. Miyauchi

3.19 STERILIZING FOODS BY COLD GAMMA RAYS

Brownell, L. E.; Lawrence, C. A.; and Graikoski, J. T. (Michigan Memorial Phoenix Project, Ann Arbor)
Refrigeration Engineering 61, No. 1, 55-57, 104 (January, 1953)

Three distinct types of ionizing radiation can be used for sterilizing foods and pharmaceuticals: alpha-particle, beta particle, and gamma radiation.

Alpha-particle radiation is not practical at the present time because of its unavailability, cost and limited ability to penetrate.

Sterilization by beta-particle radiation from a Van de Graaff machine and from a capacitron has been successfully demonstrated.

Gamma radiation is electromagnetic, as are radio waves, infrared rays, visible light, ultraviolet, X-rays, and cosmic rays.

The X-ray machine has not been considered seriously as a means of sterilizing commercial products because of its expense. Great improvements, however, have been made in beta-particle accelerating machines and they have been considered practical for sterilizing many products, particularly packaged products of small thickness. One limitation of beta-particle radiation is its limited penetration. A 2 million-volt machine will produce electrons that will penetrate only about 1/2 inch of tissue or aqueous substance.

The Stanford Research Institute Report has created considerable interest in the possible use of radioactive waste fission products. Cesium -137, which has a half life of 33 years and decays to barium -137 which emits a 0.66 MEV gamma ray, has been and will continue to be produced as a by-product of uranium fission in nuclear reactors. The availability of this source of gamma rays has created an interest in their use for sterilization.

Gamma radiation has the advantage of greater penetration but has the disadvantage of less absorption. A longer time is required to sterilize with gamma radiation than with electron bombardment. For example, packaged food about 1/2 inch in thickness can be

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 ABSTRACTER: Kathryn L. Osterhaug

8.59 ASCORBIC ACID AND RHAMNOSIDES FROM SEA WATER

Anonymous
Progressive Fish-Culturist 14, No. 4, 153 (October, 1952)

Efforts to identify the components of a substance that is physiologically active in oysters and that can be measured photometrically with p-ethyl carbazole, have been reported by P. J. Wangersky of the Fish and Wildlife Service.

The carbohydrates were removed from sea water onto a column of activated charcoal and then eluted from the column with ethanol. The two white crystalline compounds which remained after evaporation of the eluate were separated by their different solubilities in 50 percent ethanol. The substance (not yet identified) that precipitated in 50 percent ethanol gave some indication of being a rhamnoside.

Evaporation of the alcohol-water mixture produced a crystalline compound that, in water solution, gave an ultraviolet absorption spectrum similar to that reported for dehydroascorbic acid. A solution of dehydroascorbic acid was therefore prepared for comparative purposes by oxidizing ascorbic acid in the presence of copper ions in solution. Both in water and in 79 percent sulphuric acid, the absorption spectrum of this oxidation product closely resembled that of the compound from sea water. The same spectra were exhibited by the colors resulting from the reaction of the oxidized ascorbic acid and from the sample of sea water with 2,4-dinitrophenylhydrazine.

Absorption spectra from samples of sea water taken in various parts of the Gulf of Mexico and spectra run on oxidized ascorbic acid showed close agreement. From these curves it was concluded that the vitamin in sea water is largely in the form of dehydroascorbic

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8.59 THE OCCURRENCE OF TRIMETHYLAMINE AND TRIMETHYLAMINE OXIDE IN FRESH WATER FISHES

Anderson, David W. Jr. and Fellers, Carl R. (Department of Food Technology, University of Massachusetts, Amherst)
Food Research 17, No. 6, 472 474 (November-December, 1952)

Nine different species of fresh water fish were examined for trimethylamine (TM) and trimethylamine oxide (TMO) by the method of Ronald and Jakobsen (1947). Only muscle tissue was analyzed. This study was made to obtain substantiating data concerning the occurrence of (TM) and (TMO) in fresh water fish from western Massachusetts.

The (TM) and (TMO) content of the flesh of the nine species analyzed appears in Table 1. Small mouth bass, pickerel, black crappie, white perch, sunfish, and blue gill were found to contain (TMO) in small quantities as compared to the oxide content of various marine fish. To obtain a sufficiently large sample in the case of small species such as the sunfish, blue gill, and yellow perch, the fillets from several fish were ground and mixed together. The (TMO) values reported for blue gill and sunfish represent an average of three samples obtained from more than 20 individuals of each species. The larger fish were analyzed separately, and the results from several individuals of the same relative size were averaged. White perch were particularly interesting in that the small specimens examined contained only traces of the oxide, whereas the large specimens contained an average of 11 milligrams percent.

The (TM) and (TMO) of hatchery-raised brown trout of varying age appears in Table 2. From the data obtained it is apparent that diet is a significant factor. These fish received food that was found to be (TMO)- and (TM)-free until they were 8 months old. The

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 ABSTRACTER: Martin Heerdt

HANDLING FRESH STOCKFISH IN SOUTH AFRICA

ASCORBIC ACID FROM SEA WATER

FOOD STERILIZATION WITH GAMMA RAYS

TRIMETHYLAMINE OXIDE IN FRESH WATER FISHES

8.59

acid. The amounts of vitamin indicated by the absorption spectra differed from the calculated amounts of carbohydrate found by the n-ethyl carbazole method. The discrepancy may result from the still unidentified "rhamnoside," which shows some color with n-ethyl carbazole. This "rhamnoside" is by far the most abundant carbohydrate in sea water. Concentrations as high as 0.1 gram to the liter have been found in inshore waters.

8.59

TABLE 1
The trimethylamine oxide and trimethylamine content of the muscle of different species of fresh water fishes

Species	Trimethylamine oxide-N, mg %	Trimethylamine-N, mg. %
Small mouth bass (*Micropterus dolomieu*)	4.8	4.4
Pickerel (*Esox niger*)	11 0	1.8
White perch (*morone americana*)	12.0	0.8
Yellow perch (*Perca flavescens*)	Undetectable	0.6
Black crappie (*Pomoxis nigro-maculatus*)	14.6	2.0
Sunfish (*Lepomis gibbosus*)	5.6	4.8
Blue gill (*Lepomis m. machrochirus*)	17.1	4.0
Eastern golden shiner (*Notemigonus c. crysoleucas*)	Undetectable	3.0
Bullhead (*Ameiurus sp.*)	Undetectable	0.6

quantity of food they received each day varied from 3 to 10 percent of their body weight. After the 8th month a mixed ration containing approximately 15 milligrams percent (TMO) and 4 milligrams percent (TM) was fed. Table 2 shows no (TMO) up to 6 months of age and increasing amounts of (TMO) thereafter. In contrast, the (TM) content decreased with an increase in age. No explanation is offered. The TMO content of the herring used in the diet of the brown trout appears to have been responsible for the (TMO) found.

TABLE 2
The trimethylamine oxide and trimethylamine content of hatchery raised brown trout (Salmo trutta fario) at different ages

Age of fish	Trimethylamine oxide-N, mg.%	Tvimethylamine-N, mg %
Roe	Undetectable	Undetectable
Six months	Undetectable	1.7
Two years	7.5	4.5
Four years	16.0	2.9
Five years	18.5	0.9

2.0

A delay in icing of only 3 hours at 66°F. was sufficient to cause a noticeable effect on the quality of fish stored 12 days in ice. Stockfish stored in ice in the round were said to keep as well as headed and gutted fish, except for more softening in the region of the belly cavity. The gain in weight of the former was 1 percent as compared with 2.8 percent for the latter. Keeping quality was improved by salting the belly cavity before icing; the salt-treated fish were appreciably firmer than the controls after storage. When sodium nitrite (about 6 grams per fish) was used in the belly cavity, the odor was fresher than that of the controls after storage.

A test was made to measure the gain of water and loss of solid matter by fish during 12 days storage in ice. The fish used gained 2.55 percent in weight during storage. Before storage the flesh had 18.6 percent protein and 78.8 percent moisture; after storage it had 15.6 percent protein and 83.0 percent moisture. The flesh content was about 85 percent of the fish. Based on the weight of the original fish, it gained about 5.5 percent water and lost 2.1 percent protein. The melted ice had a protein content of 2 percent based on the original weight of fish.

3.19

sterilized in a fraction of a second with electron bombardment, while packaged food having a thickness of 12 inches or more would be irradiated for from several minutes to several hours to give complete sterilization. However, the radiation dosage is more uniform with gamma irradiated foods. Where irradiation results in flavor changes, this difference in uniformity is an important consideration. Another difference between gamma radiation and electron bombardment is in the field covered by the radiation beam. The accelerating machine delivers a beam that is more or less collimated, whereas a radioactive gamma ray source radiates in all directions. Therefore, in developing designs for using gamma radiation, one generally considers a radiation chamber in which an appreciable volume may be irradiated at one time in contrast to the successive radiations of much smaller volumes when using accelerating machines.

Many questions must be answered before the real potentialities of gamma radiation can be evaluated. One of the first is the dosage required to kill various organisms. A wide variety of bacteria, molds, yeasts and viruses were tested and spore-forming bacteria were found to be the most resistant organisms tested. Much smaller dosages were required to destroy the non-spore-forming types of bacteria. Experiments have shown that certain pathogenic viruses are much more susceptible to radiation than sporulating bacteria.

Taste-tests on foods that had been treated with gamma radiation revealed the presence of numerous off flavors. Foods of animal origin appear to be particularly sensitive. Milk, fresh meats, eggs, and cheese undergo undesirable flavor changes. These changes seem to be of two general types: (1) proteins develop an animal or "goaty" odor and flavor; and (2) fats become rancid. Various chemical additives have been used in an attempt to prevent these changes, with some success.

Three important steps must be taken before food can be preserved by gamma radiation on a commercial basis: (1) food so sterilized must be proved acceptable to the Food and Drug Administration's requirements and to consumers' tastes; (2) industry must show an interest in supporting research to make the process commercially feasible; and (3) the Atomic Energy Commission must make suitable fission product gamma-ray sources available in sufficient quantities and at reasonable cost.

1.85 RECOVERY AND PALATABILITY OF DIFFERENT SPECIES OF SHRIMP AFTER COOKING

Anonymous
Commercial Fisheries Review 14, No. 11, 12-13 (November, 1952)

During the early part of 1951, recovery and palatability tests were conducted by home economists of the U. S. Fish and Wildlife Service on the four main varieties of shrimp marketed in the United States. These included the white shrimp (Peneaus setiferus, Peneaus stylerostris, and Peneaus vannemei), the brown-grooved shrimp (Peneaus aztecus), the pink-grooved shrimp (Peneaus duorarum), and the Greenland red shrimp (Pandalus borealis). All shrimp used in the tests were frozen headless. After thawing, weighing, and counting, the samples were placed in boiling brine, covered, and simmered for five minutes. Immediately after cooking they were drained, allowed to cool, weighed, peeled, and weighed again. The sand veins were then removed and the shrimp were weighed a third time. The results are shown in the accompanying table.

Recovery for the boiled, peeled, and drained shrimp was the highest for the brown-grooved shrimp, and the lowest for the red Greenland shrimp. The percentage of recovery of the latter was the lowest of the four varieties tested, even before deveining. The percentage of recovery for both the white and pink-grooved shrimp was the same when cooked, peeled, and deveined. Before deveining, however, the pink-grooved shrimp showed a higher percentage of recovery than the white shrimp. Three of the five lots of white shrimp were larger in size (count per pound) than the rest. However, these three lots had a slightly lower average percentage of recovery. Whether size has any relation to the percentage of recovery is not known.

All species were rated as acceptable organoleptically.

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 ABSTRACTER: Roy C. Stevens

5.2 THE MECHANISM OF THE FISH THIAMINASE

Davis, N. C.
Iowa State College Journal of Science 25, 195-197 (1951)

Manganous ion is an integral part of the thiaminase system obtained from fish. Another factor, non-dialysable and non-heat-labile, is required: this can be replaced by m-nitroaniline. m-Aminobenzoic acid and m-nitroaniline are potent activators of both dialysed and undialysed preparations of thiaminase. The effect on dialysed preparations is enhanced by manganous ion. The product from activation by m-nitroaniline was shown to be N-(2-methyl-6-amino-pyrimidyl-5-methyl)-m-nitroaniline, i.e. nitroaniline is coupled with the pyrimidine moiety of thiamine. Thiaminase is inhibited by inhibitors specific for sulphydryl groups. Inhibition by iodine was reversed by excess of cysteine. Cysteine is thought to function as a regulator of the oxidation-reduction state of the enzyme sulphydryl groups. Attempts to purify thiaminase by fractional precipatation were unsuccessful.

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3.238 PACKAGING TESTS OF GLAZED AND UNGLAZED SHRIMP

Adams, Ernest; Klein, Marian; and Simerl, L. E. (Marathon Corporation, Menasha, Wisconsin)
Quick Frozen Foods 15, No. 6, 55-57 (January, 1953)

Extensive tests were conducted to determine the effect of packaging upon the keeping quality of shrimp held in cold storage. Five-pound packages of headed, unpeeled raw shrimp were filled under commercial conditions using two types of cartons with improved construction, and the present commercial stapled cartons. Both white and brown shrimp were used in the tests.

The packages had the following variations in glazing and wrapping:

A. Glazed:
(1) High gloss waxed stapled commercial carton, no overwrap;
(2) High gloss waxed solid bleached carton, no overwrap;
(3) High gloss waxed solid bleached carton, cellophane overwrap;
(4) High gloss waxed solid bleached carton, Tyton overwrap.

B. Unglazed:
(5) High gloss waxed solid bleached carton, no overwrap;
(6) High gloss waxed bleached carton cellophane overwrap;
(7) High gloss waxed solid bleached carton, Tyton overwrap.

All packages were weighed and held in storage at zero degrees F. At intervals of three and six months samples were removed, package weight loss determined and the amount and location of any desiccation observed. Moisture losses are shown in the accompanying table. The weight losses are given on the basis of the total package weight, which includes shrimp, glazing water if any, carton, and overwrap, if any. Because of glazing water, it was

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 ABSTRACTER: Roy C. Stevens

6.54 UTILIZATION OF STOCKFISH FILLET TRIMMINGS

Rowan, A. N. and Lewis, A. M.
Fishing Industry Research Institute (South Africa), 5th Annual Report (1952) 8

A preliminary study was made of the possibility of salvaging the edible portions of filleting wastes at the smokeries. For brined fish weighing 3 to 4 pounds, the fillet yield was 74.0 percent and the offcuts 26.0 percent. For fish weighing 1 to 2 pounds the fillet yield was 79.0 percent and the offcuts 21.0 percent. About 17 percent of the total flesh is removed in the filleting of stockfish.

An inexpensive method of preserving this flesh recovered from offcuts and trimmings for human consumption is to cook the material, separate the flesh from bones and fins, salt (e.g., 25 percent salt for several days), and press out as much liquid as possible (without the expense of drying). The resulting product had a salt content of about 30 percent and a moisture content of 40 percent. This product could be desalted and made into fish croquettes that were tender and satisfactory in flavor.

 ABSTRACTER: D. T. Miyauchi

COOKED SHRIMP RECOVERY AND PALATABILITY

EFFECT OF PACKAGING ON FROZEN SHRIMP QUALITY

MECHANISM OF THIAMINASE

FILLET TRIMMINGS FOR HUMAN CONSUMPTION

3.238 (Cross Reference: 1.85)

impractical to determine moisture loss on the net weight of the shrimp.

On examination at three months, the glazed packages were still in good condition, with only slight desiccation. The overwrapped packages were in very good condition.

After six months, the overwrapped packages of both glazed and unglazed shrimp showed a negligible weight loss of 0.3 percent or less. Both glazed and unglazed packages without overwrap showed high weight losses, from 2 to 8 percent.

The overwrapped packages in which the shrimp were packed without a glaze were in excellent condition after six months storage, as judged both by visual observation and by taste testing. The shrimp were said to have maintained good flavor and texture.

The shrimp in both glazed and unglazed packages that did not receive an overwrap exhibited slight to severe desiccation and were slightly tough. Texture appeared to be the factor most adversely affected by loss of moisture.

WEIGHT LOSS OF SHRIMP PACKAGES AFTER STORAGE AT 0° F.

	Packaging Materials	Texas Shrimp 3 Months	Texas Shrimp 6 Months	Louisiana Shrimp 3 Months	Louisiana Shrimp 6 Months
	Glazed				
1	High Gloss Stapled Commercial Carton, No Overwrap	3.8%	8.0%	2.1%	6.0%
2	Marathon High Gloss SB Carton, No Overwrap	1.9	2.7	1.9	4.0
3	Marathon High Gloss SB Carton, Cellophane Overwrap	0.1	0.1	0.0	0.0
4	Marathon High Gloss SB Carton, Tylon Overwrap	0.0	0.1	0.1	0.2
	Unglazed				
5	Marathon High Gloss SB Carton, No Overwrap	1.2	2.1	2.0	5.2
6	Marathon High Gloss SB Carton, Cellophane Overwrap	0.2	0.2	0.1	0.0
7	Marathon High Gloss SB Carton, Tylon Overwrap	0.0	0.1	0.0	0.3

1.85 (Cross Reference: 2.3)

PERCENTAGE OF RECOVERY AND PALATABILITY OF DIFFERENT SPECIES OF HEADLESS SHRIMP AFTER COOKING

Species	Lot	Raw Weight	Count 1/	Boiled in Shell		Boiled and Peeled		Boiled, Peeled, and Deveined	
				Weight	Percentage Recovery of Raw Weight	Weight	Percentage Recovery of Raw Weight	Weight	Percentage Recovery of Raw Weight
	No.	Grams	No.	Grams	Percent	Grams	Percent	Grams	Percent
White or Common	1	454	16	357	78.6	256	56.4	235	51.8
	2	454	17	334	73.6	243	53.5	225	49.6
	3	454	19	346	76.2	250	55.1	230	50.7
	4	454	23	360	79.3	263	57.9	239	52.6
	5	454	25	360	79.3	250	55.1	231	50.9
Average		454	20	351	77.4	254	55.6	232	51.1
Brown-Grooved	1	454	25	374	82.4	274	60.4	242	53.3
	2	454	26	388	85.5	287	63.2	249	54.8
	3	454	28	347	76.4	264	58.1	239	52.6
Average		454	26	370	81.4	275	60.6	243	53.6
Pink-Grooved	1	454	23	360	79.3	257	56.6	231	50.9
	2	454	23	404	89.0	276	60.8	240	52.9
	3	454	24	390	85.9	264	58.1	224	49.3
Average		454	23	385	84.7	266	58.5	232	51.0
Green-and Red	1	454	89	358	78.9	200	44.1	177	39.0
	2	454	92	378	83.3	209	46.0	171	37.7
Average		454	90	368	81.1	204	45.0	174	38.3

NOTE. 454 GRAMS EQUAL ONE POUND. 1/ COUNT MEANS THE NUMBER OF HEADLESS SHRIMP PER POUND.

6.18 BOSTON FIRM USES FERMENTED FISH IN NEW SOIL FERTILIZER

Bunker, John
Maine Coast Fisherman 7, No. 6, 8 (January, 1953)

A new soil fertilizer using fermented fish as its principal ingredient has been developed by a Boston company. The new product is described as "a liquid, concentrated and complete organic, deodorized fertilizer for all plants". Its producers hope that it will open up a big field for the use of fishery by-products in the manufacture of fertilizers for home gardens.

The product consists mainly of fresh fish that has been liquefied, concentrated, sterilized and fermented. Also incorporated in the fertilizer are specially selected carbohydrates to supply energy and food to certain groups of plant organisms.

 ABSTRACTER: Roy C. Stevens

6.193 UNIDENTIFIED FACTORS IN BY-PRODUCTS OF FISH REQUIRED FOR CHICK GROWTH

Berg, Lawrence R. (State College of Washington, Pullman)
Southern Fisherman 12, No. 11, 79-80 (November, 1952)

It has long been recognized that the protein of fish meal is of excellent quality for use in all types of poultry rations, including chick rations, developing rations, laying rations, and rations for growing turkeys. Even as the comparatively cheap and plentiful vegetable proteins, such as soybean oil meal, became available, it was recognized that fish meal was one of the best sources of supplemental amino acids.

During the 1940's, when it was determined that fish meal and fish solubles contained an unknown factor required for livability and growth of chicks and turkeys and hatchability of eggs, fish meal became even more popular. That factor has since been isolated and is now known as vitamin B_{12}. Shortly after this discovery it was found that antibiotics added to chick or turkey starter feeds in amounts as small as two to ten parts per million increased growth by 15 to 20 percent. With this development it appeared that there would no longer be a need for animal proteins in poultry feeds if vegetable protein diets were supplemented with vitamin B_{12} and an antibiotic.

As more experimental work was completed, however, evidence of a further value for fish meal and fish solubles in addition to its protein and vitamin B_{12} became apparent. Experiments conducted at various experiment stations throughout the country indicated that the inclusion of two to five percent fish meal or fish solubles in diets made up of vegetable proteins with antibiotics would give a growth response of from 15 to 30 grams in chicks at four weeks of age in many trials, although there were trials in which little

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 ABSTRACTER: Roy C. Stevens

6.3 THE PROPERTIES OF THE ALGAL CHEMICALS. I. THE EVALUATION OF THE COMMON BRITISH BROWN MARINE ALGAE AS A SOURCE OF ALGINATE

Black, W. A. P.; Cornhill, W. J.; and Dewar, E. T. (The Institute of Seaweed Research, Inveresk, Midlothian)
Journal of the Science of Food and Agriculture 3, No. 11, 542-550 (November, 1952)

The authors determined the viscosities of 0.25 percent sodium alginate solutions of P. canaliculata, F. spiralis, A. nodosum, F. vesiculosus, F. serratus, L. cloustoni, L. saccharina, and L. digitata in 0.1 N sodium chloride at 25°C. In solutions prepared from fresh Laminariaceae the viscosities were found to vary from 17 to 72 cs. Regardless of the species of Laminariaceae investigated, solutions prepared from the frond were of a higher viscosity than solutions prepared from the stipe. L. cloustoni stipe yielded the poorest grade of sodium alginate in all the Laminariaceae. With fresh Fucaceae, viscosities varying between 5.8 and 10.9 cs. indicated no great difference in quality.

Pretreatment of the weed prior to extraction had various effects upon the quality or grade of sodium alginate obtained. When the Laminariaceae were dried at 60° to 80°C. before extraction, a marked loss in grade occurred, particularly in the high-viscosity samples, so that all of the dried species yielded viscosities ranging from 10 to 18.5 cs. In the Fucaceae, however, drying at 60° to 80°C. raised the quality so that viscosities ranging between 7.1 and 12.1 cs. were obtained. Bleaching of the sodium alginate solutions produced a further drop in the viscosity of all species examined. In the Fucaceae, sodium hypochlorite or hydrogen peroxide bleaching caused an apparent loss of alginate.

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 ABSTRACTER: Martin Heerdt

8.6175 COD LIVER AND COD LIVER OIL FROM HORNAFJORDUR

Thorbjarnarson, Thordur
Report on Technological Research Concerning the Icelandic Fish Industry VI (1944-1946) 36-41

Cod liver oil produced during the winter fishing season in Hornafjordur, a fishing center on the southeast coast of Iceland, has during the last few years shown a very much higher vitamin A potency than oils produced, during the same time of year, in fishing centers on the south and southwest coasts. A reference to Fig. I on page 4 will confirm this fact.

The present work was undertaken to clarify the reasons for the high vitamin A content of the Hornafjordur oil. The investigation showed that the oil content of the liver catch in Hornafjordur, during the period covered by the investigation (March 24th - April 4th), was only 54-57% whereas in the two chief fishing centers on the south and southwest coast the oil content was 62-63% and 68% respectively. During the investigation a single day's catch for one boat, amounting to 195 fish, was divided into size groups. The average age for each group was estimated, the weight of the livers and their oil content were determined and the vitamin A content of the oil was tested. The results of this investigation, which are presented in Table I, show that the fish were both larger and older than fish caught in other parts of the country. Certain surprising variations were observed, which were as follows: in the liver weight, 9.05-2.91%; in the oil content of the livers, 67.4-36.2%; and in the vitamin A content of the oil, 2,040-38,400 U.S.P. units/g. These great variations led to an attempt to sort a single lot of livers into fat, medium fat and lean, which then were rendered separately in order to obtain oils with varying vitamin A contents. The results of this experiment, which are presented in

(over)

 English summary

FERMENTED FISH FERTILIZER

PROPERTIES OF ALGAL CHEMICALS

UNIDENTIFIED GROWTH FACTOR IN FISH MEAL

ICELANDIC COD LIVER OIL

6.3

The possibility is recognized that the viscosity of sodium alginate extracted from fresh species will vary with the season of the year, depth of immersion, habitat, stage of plant development, and the particular point of sampling.

The specific rotations of the sodium alginate from each species were found to lie within the range -139 ± 10°.

Drying L. digitata frond either in air or in a vacuum desiccator over anhydrous calcium chloride or phosphorous pentoxide resulted in no appreciable loss in the grade of the sodium alginate produced. Thermal drying, however, even for only 4 1/2 hours at 27°C., produced an alginate of much lower viscosity. In contrast, pure solutions of high-grade sodium alginate remained stable after 4 1/2 hours at 40°C. and showed almost no loss in viscosity after standing at room temperature for 13 days.

8.6175 (Cross Reference: 1.5)

Table II, show that the oil percentage for the liver groups ranged from 60.7% to 19.3% and the vitamin A content of the oil ranged from 4560 to 35900 U.S.P. units/g.

6.193

or no response was obtained.

The original difficulty in studying this new factor was the inconsistency of results. Accordingly, the author conducted a series of experiments in an effort to establish a basal diet that would allow a consistent, significant response each time that test materials were added to it. In the course of these tests it was found that the source and amount of carbohydrate in the diet affected the growth response obtained with fish meal. It can be concluded either that the factor is present in small quantities in the natural ingredients of chick diets or that the requirement for the chick for maximum growth is quite high. The factor appears to be concentrated at five to seven times as great in fish meal as in corn and two to three times as great in fish meal as in soybean oil meal.

1.01 FISH PRESERVATION DOWN THE AGES

Cutting, C. L.
Chemistry and Industry No. 46, 1110-1115 (November 15, 1952)

(Abstract of this article appears under 3.0 page 7)

1.2 HERRING PROCESSING MACHINERY

Anonymous
Food Science Abstracts 24, No. 6, 526 (November, 1952)

(Abstract of this article appears under 0.12 page 11)

1.2 THE FREEZING AND COLD STORAGE OF HERRINGS

Banks, A.
Food Investigation Special Report No. 55, Department of Scientific and Industrial Research, 40 pp. (1952)

(Abstract of this article appears under 3.230 page 7)

1.2 ANALYSES OF BRITISH COLUMBIA SALT HERRING

Schmidt, P. J.
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 92, 3-5 (October, 1952)

(Abstract of this article appears under 3.5 page 7)

1.30 A STAKE IN STEAKS

Anonymous
Pacific Fisherman 50, No. 12, 63-69 (November, 1952)

(Abstract of this article appears under 3.23 page 11)

1.5 THE FLORA OF ARCTIC COD

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 10-11 (1952)

(Abstract of this article appears under 0.5 page 3)

1.5 COD LIVER AND COD LIVER OIL FROM HORNAFJORDUR

Thorbjarnarson, Thordur
Report on Technological Research Concerning the Icelandic Fish Industry VI, (1944-1946) 36-41

(Abstract of this article appears under 8.6175 page 19)

1.61 A STAKE IN STEAKS

Anonymous
Pacific Fisherman 50, No. 12, 63-69 (November, 1952)

(Abstract of this article appears under 3.23 page 11)

1.82 HARD-CLAM FISHERY OF THE ATLANTIC COAST

Tiller, Richard E.; Glude, John B.; and Stringer, Louis D.
Commercial Fisheries Review 14, No. 10, 1 (October, 1952)

The report deals with the present status and past trends of the fishery for the hard clam or quahaug (Venus mercenaria), the types of gear employed, and the particular problems facing the industry in each of the Atlantic coastal states.

1.85 PACKAGING TESTS OF GLAZED AND UNGLAZED SHRIMP

Adams, Ernest; Klein, Marian; and Simerl, L. E.
Quick Frozen Foods 15, No. 6, 55-57 (January, 1953)

(Abstract of this article appears under 3.238 page 17)

1.95 PRESERVATION AND QUALITY OF WHALEMEAT

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 22-23 (1952)

(Abstract of this article appears under 2.00 page 5)

2.14 ELECTRICAL-FISHING EXPERIMENTS IN SALT WATER REPORTED SUCCESSFUL

Peterson, C. E. (Statistical Section, U. S. Fish and Wildlife Service, Washington, D. C.)
Commercial Fisheries Review 14, No. 10, 62 (October, 1952)

2.19 FREEZING BRITISH COLUMBIA FISH AT SEA. II

Lantz, A. W.
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 92, 21-22 (October, 1952)

(Abstract of this article appears under 7.80 page 9)

2.19 COOLING PROBLEMS IN FISHING VESSELS

Rathke, A.
Fischereiwelt 3, 108-109 (1951)

2.3 RECOVERY AND PALATABILITY OF DIFFERENT SPECIES OF SHRIMP AFTER COOKING

Anonymous
Commercial Fisheries Review 14, No. 11, 12-13 (November, 1952)

(Abstract of this article appears under 1.85 page 17)

2.5 RAIL TRANSPORTATION OF PERISHABLE FOODSTUFFS

Tewksbury, R. B. (Fruit Dispatch Company, New York City)
Refrigerating Engineering 61, No. 1, 52 (January, 1953)

2.8 OYSTER COOKERY

Beck, Leonard N. and Moore, Jeffrey
Gourmet 13, No. 1, 12 (January, 1953)

2.9 FISH POISONING CAUSED BY HISTAMINE IN INDONESIA

Van Veen, A. G. and Latusan, H. E.
Documenta Neerlandica et Indonesica de Morbis Tropicis 2, No. 1, 18-20 (1950) (In English)

2.9 ON THE ASSAY METHOD OF PUFFER POISON

Hashimoto, Y. and Migita, M.
Bulletin of the Japanese Society of Scientific Fisheries 16, 341 (1951)

3.0 HERRING PROCESSING MACHINERY

Anonymous
Food Science Abstracts 24, No. 6, 526 (November, 1952)

(Abstract of this article appears under 0.12 page 11)

3.230 FREEZING OF FISH

Anonymous
Fishing Industry Research Institute (South Africa), Fifth Annual Report (1952) p. 10

3.230 FREEZING BRITISH COLUMBIA FISH AT SEA. II

Lantz, A. W.
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 92, 21-22 (October, 1952)

(Abstract of this article appears under 7.80 page 9)

3.234 STUDIES ON THE MUSCLE OF THE AQUATIC ANIMALS. 11. ON THE DENATURATION OF FISH MUSCLE PROTEIN CAUSED BY FREEZING AND SALTING, AND THE RELATION BETWEEN THEM

Simidu, Wataru and Hibiki, Sigeyuki
Bulletin of the Japanese Society of Scientific Fisheries 17, No. 10, 301 (1951)

(Abstract of this article appears under 0.32 page 1)

3.239 IMPROVING THE QUALITY OF FROZEN MEAT

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 20-21 (1952)

(Abstract of this article appears under 2.02 page 3)

3.30 DEVELOPMENTS IN CANNING

Anonymous
Fishing Gazette 69, No. 10, 45 (October, 1952)

3.30 CRYSTALS IN CANNED SHRIMP

Greenleaf, C. A. and Hendrickson, Norman
National Canners Association Circular Number 18-L (January, 1942)

This is an article for the layman on the formation of struvite crystals in canned shrimp and other seafoods.

3.33 CAUSE OF THE BROWNING OF CERTAIN HEAT-PROCESSED FISH PRODUCTS

Tarr, H. L. A.
Fisheries Research Board of Canada, Progress Reports of the Pacific Coast Stations, No. 92, 23-24 (October, 1952)

(Abstract of this article appears under 0.33 page 1)

3.4 THE PRODUCTION OF SMOKED SALMON

Hermann, K.
Fischw.- u. Feinkostind 23, 70-71 (1951)

3.5 BROWNING OF SALT FISH

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 10 (1952)

(Abstract of this article appears under 0.33 page 5)

3.5 STUDIES ON THE MUSCLE OF THE AQUATIC ANIMALS. 11. ON THE DENATURATION OF FISH MUSCLE PROTEIN CAUSED BY FREEZING AND SALTING, AND THE RELATION BETWEEN THEM

Simidu, Wataru and Hibiki, Sigeyuki
Bulletin of the Japanese Society of Scientific Fisheries 17, No. 10, 301 (1951)

(Abstract of this article appears under 0.32 page 1)

3.7 STUDIES ON THE MANUFACTURE OF CONSERVATIVE MARINE FOOD PRODUCTS. IX. ON THE MANUFACTURE OF PRESS-DRIED FISH

Tanikawa, Eiichi; Akiba, Minoru and Motohiro, Terushige
Bulletin of the Faculty of Fisheries, Hokkaido University 2, No. 1, 65 (June, 1951)

When the water contents of products were approximately below 16%, the molds could not germinate.

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

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Analytical Chemistry
Archives of Biochemistry and Biophysics
Atlantic Fisherman
Australian Journal of Marine and Freshwater Research
Biochemical Journal
California Fish and Game
Canadian Fisherman
Canadian Journal of Chemistry
Canadian Journal of Technology
Canner
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemistry and Industry
Commercial Fisheries Review
Commercial Fisherman
Drug and Cosmetic Industry
Federation Proceedings
Feedstuffs
Fish Meal and Oil Industry
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Fisheries Newsletter (Australia)
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Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Home Economics
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Modern Packaging
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Modern Sanitation
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Nature
Nutrition Reviews
Oil, Paint and Drug Reporter
Pacific Fisherman
Pan-American Fisherman
Poultry Science
Practical Home Economics
Progressive Fish-Culturist
Quick Frozen Foods
Refrigerating Engineering
Report of the Food Investigation Board (Great Britain)
Science
Seafood Business
Southern Fisherman
Trade News (Fisheries Department, Canada)
Western Canner and Packer
Western Fisheries
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above listed publications are included. Biological papers are generally omitted.

3.7 STUDIES ON THE COMPLETE UTILIZATION OF SQUID (OMMASTREPHES SLOANI PACIFICUS). VI. STUDIES ON THE MANUFACTURE OF "SURUME" (DRIED SQUID)(1). THE CAUSE AND THE METHOD OF PREVENTION OF SO CALLED "MORNING-BURN" OF "SURUME" (DRIED SQUID)

Tanikawa, Eiichi and Akiba, Minoru
Bulletin of the Faculty of Fisheries, Hokkaido University 3, No. 1, 81 (May, 1952)
(In Japanese with English summary, table and figure)

3.8 BACTERIOLOGICAL STUDIES OF SHIOKARA OR "SOUSED SQUID" 2. THE STUDIES ON THE CHEMICAL CHANGES IN THE RIPENING PROCESS

Nagao, Kiyoshi and Kimura, Takahisa
Bulletin of the Faculty of Fisheries, Hokkaido University 1, No. 2, 81 (February, 1951)
(In Japanese with English summary, tables and figures)

3.8 BACTERIOLOGICAL STUDIES OF SHIOKARA OR "SOUSED SQUID" 3. ON THE VARIATIONS OF NUMBER OF BACILLI IN SHIOKARA DURING ITS RIPENING

Nagao, Kiyoshi
Bulletin of the Faculty of Fisheries, Hokkaido University 2, No. 2, 145 (September, 1951)
(In Japanese with English summary and tables)

3.8 INVESTIGATIONS INTO THE PREPARATION OF COLD MARINADES. V. ON THE TIME COURSE OF THE CURING PROCESS UNDER VARIOUS CONDITIONS

Wille, O. and Kuhlmorgen, G.
Fischw.- u. Feinkostind 23, 67-70 (1951)

3.8 THE SIGNIFICANCE OF THE RAW MATERIAL, PARTICULARLY ITS BACTERIAL CONTENT, FOR THE STABILITY AND QUALITY OF MARINADES

Schwanenberg, G.
Fischw.- u. Feinkostind 23, 99-100, 109 (1951)

3.9 STUDIES ON THE MANUFACTURE OF CONSERVATIVE MARINE FOOD PRODUCTS. X. PRESERVATION OF MARINE FOOD PRODUCTS IN RHYPHAN SAC

Tanikawa, Eiichi; Fukuda, Masahiko and Akiba, Minoru
Bulletin of the Faculty of Fisheries, Hokkaido University 1, No. 2, 156 (September, 1951)
(In Japanese with English summary, tables and figures)

4.21 PREPARATION OF PEROXIDE CONCENTRATES FROM AUTOXIDIZED FATTY ACID ESTERS

Privett, O. S.; Lundberg, W. O.; and Nickell, Christense
Journal of the American Oil Chemists' Society 30, No. 1, 17 (January, 1953)

4.61 PRESERVATION AND QUALITY OF WHALEMEAT

Anonymous
Report of the Food Investigation Board (Great Britain) For The Year 1951, 22-23 (1952)

(Abstract of this article appears under 2.00 page 5)

4.64 THE RELATIVE RATES OF DESTRUCTION OF PROPYL GALLATE AND BUTYLATED HYDROXYANISOLF IN OXIDIZING LARD

Mahon, J. H. and Chapman, R. A.
Journal of the American Oil Chemists' Society 30, No. 1, 34 (January, 1953)

4.89 STUDIES ON THE ANTIBIOTIC ACTION OF FISH COMPONENTS -- I. PRODUCTION OF THE ANTIBIOTIC ACTION OF THE SHARK LIVER BY ADDING CUPRIC SALTS

Tomiyasu, Yukio and Toyomizu, Masamichi
Bulletin of the Japanese Society of Scientific Fisheries 18, No. 4, 155 (1952)

5.111 STUDIES IN VITAMIN A. 21. RETINENE$_2$ AND VITAMIN A$_2$

Cama, H. R.; Dalvi, P. D.; Morton, R. A.; and Salah, M. K. (Department of Biochemistry, University of Liverpool)
Biochemical Journal 52, No. 4, 542 (December, 1952)

5.41 PROPERTIES AND DISTRIBUTION OF VITAMIN B_{12f}

Lewis, U. J.; Tappan, D. V. and Elvehjem, C. A. (Department of Biochemistry, College of Agriculture, University of Wisconsin, Madison)
Journal of Biological Chemistry 199, No. 2, 517 (December, 1952)

5.41 CHROMATOGRAPHIC SEPARATION AND MICROBIOLOGICAL ASSAY OF INDIGENOUS AND ADDED COBALAMINS IN CRUDE ANIMAL PROTEIN MATERIALS

Tarr, H. L. A.
Canadian Journal of Technology 30, No. 10 and 11, 265-279 (October-November, 1952)

(Abstract of this article appears under 7.641 page 9)

5.42 UNIDENTIFIED GROWTH FACTORS REQUIRED BY CHICKS AND POULTS. 2. FRACTIONATION OF A FACTOR IN LIVER

Menge, H. and Combs, G. F. (Department of Poultry Husbandry, University of Maryland, College Park)
Poultry Science 31, No. 6, 994 (November, 1952)

6.0 EVERY PART OF A FISH IS MADE TO COUNT AT THIS GLOUCESTER BY-PRODUCTS PLANT

Anonymous
De Laval Centrifugal Review XVIII, No. 4, 3, Fourth Quarter, 1952

6.0 RECENT PROGRESS IN FISHERY BY-PRODUCTS RESEARCH OF INTEREST TO THE ANIMAL FEED INDUSTRY

Sanford, F. Bruce
Proceedings of the Fifth California Animal Industry Conference, Sacramento, California, October 23-24, 1952, 79

6.139 THE EFFECT OF HEAT ON THE LYSINE AND METHIONINE IN SUNFLOWER SEED OIL MEAL

Alexander, J. C. and Hill, D. C. (Department of Nutrition, Ontario Agricultural College, Guelph, Canada)
Journal of Nutrition 48, No. 2, 149 (October 10, 1952)

Autoclaving at 15 lb. pressure and dry heating at 121°C. destroyed a large proportion of the lysine in sunflower seed oil meal.

6.139 EFFECT OF HEAT ON SOLVENT-EXTRACTED SOYBEAN OIL MEAL

Burnet, George Jr. and Arnold, Lionel K. (Chemical Engineering Department, Iowa State College, Ames, Iowa)
Journal of the American Oil Chemists' Society 29, No. 12, 619 (December, 1952)

6.190 NEW DEVELOPMENTS IN MEAT BIRD NUTRITION

Couch, J. R.; Reed, J. R. Jr.; Atkinson, R. L.; and Dieckert, J. W.
Proceedings of the Fifth California Animal Industry Conference, Sacramento, California, October 23-24, 1952 85

6.190 WHITHER FISHMEAL?

Golden, Samuel M. (President, Amburgo Co., Inc., Philadelphia, Pennsylvania)
Fish Meal and Oil Industry 4, No. 9, 6 (September, 1952)

6.190 PROVIDING VITAMIN B_{12}, ANTIBIOTIC AND UNKNOWN GROWTH FACTOR ACTIVITY FOR CHICK DIETS

Johnson, Elton L. (Department of Poultry Husbandry, Iowa State College, Ames)
Poultry Science 31, No. 6, 955 (November, 1952)

"Fish solubles and homogenized condensed fish produced different growth rates in chicks fed diets deficient in vitamin B_{12}. The difference in these two marine products when fed at a three percent level was demonstrated to be the result of a higher level of vitamin B_{12} in the fish solubles."

6.190 FAILURE OF SEVERAL AMINO COMPOUNDS AND OF SARDINE MEAL TO INACTIVATE GOSSYPOL IN DIETS OF BREEDING CHICKENS

Heywang, Burt W. and Bird, H. R. (Agricultural Research Administration, Glendale, Arizona and Beltsville, Maryland)
Poultry Science 31, No. 5, 805 (September, 1952)

6.190 TEXAS MEETING INCLUDES TALKS ON FEED EFFICIENCY, PROTEIN SAVING

Newell, Martin E.
Feedstuffs 24, No. 43, 6 (October 25, 1952)

6.233 THE VITAMIN B_{12} ACTIVITY OF NATURAL MATERIAL WITH PARTICULAR REFERENCE TO COD LIVER PROTEIN

Guttmann, A.
Journal of the Fisheries Research Board of Canada IX, No. 3, 129-140 (September, 1952)

(Abstract of this article appears under 7.64 page 9)

6.3 STUDIES ON THE METHODS FOR ANALYZING THE CHEMICAL COMPONENTS OF SEAWEEDS

Suzuki, Noboru
Bulletin of the Faculty of Fisheries, Hokkaido University 3, No. 1, 58 (May, 1952)

Part I - On the Determination of Iodine; Part II - On the Determination of Potassium; Part III - On the Determination of Mannit

6.3 STUDIES ON THE PREPARATION AND THE UTILIZATION OF ALGINIC ACID DERIVATES - I. THE CONDENSATE OF ALGINIC ACID HYDROLYSATE AND PALMITIC ACID AS AN EMULSIFIER

Abe, Yoshio and Ihara, Toyoko
Bulletin of the Japanese Society of Scientific Fisheries 18, No. 1, 47 (August 25, 1952)
(In Japanese with English summary, tables and figures)

6.3 STUDIES ON THE PREPARATION AND THE UTILIZATION OF ALGINIC ACID DERIVATIVES. III. THE ORGANIC BASE SALT OF ALGINIC ACID AS AN EMULSIFIER

Abe, Yoshiro and Ihara, Toyoko
Bulletin of the Japanese Society of Scientific Fisheries 18, No. 1, 55 (August 25, 1952)
(In Japanese with English summary, tables and figures)

6.51 POTENTIAL MARKETS FOR ALASKA SALMON CANNERY WASTE

Wigutoff, Norman B.
Commercial Fisheries Review 14, No. 8. 5-12 (August, 1952)

(Abstract of this article appears under 6.52 page 11)

6.54 STUDIES ON FISH MEAL JELLIES. II. A METHOD FOR DETERMINING JELLY STRENGTHS OF FISH MEAT JELLIES

Matsumoto, Juichiro and Arai, Tomiko
Bulletin of the Japanese Society of Scientific Fisheries 17, No. 12, 377 (1952)
(In Japanese with English summary, tables and figures)

6.63 STUDIES ON PROTEIN HYDROLYSIS. I. PRELIMINARY OBSERVATIONS ON THE TASTE OF ENZYMIC PROTEIN-HYDROLYSATES

Murray, T. K. and Baker, B. E.
Journal of the Science of Food and Agriculture 3, No. 10, 470 (October, 1952)

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8.51 D-AMINO-ACID OXIDASE IN THE MOLLUSCAN LIVER

Blaschko, H. and Hawkins, Joyce (Department of Pharmacology, University of Oxford, Oxford, England)
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9.15 A CULTURE TECHNIQUE FOR THE DIAGNOSIS OF INFECTIONS WITH DERMOCYSTIDIUM MARINUM MACKIN, OWEN, AND COLLIER IN OYSTERS

Ray, Sammy M. (Biology Department, Rice Institute, Houston, Texas)
Science 116, No. 3014, 360 (October 3, 1952)

9.16 FISH FARMING IN MALAYA

De Zylva, E. R. A. (Acting Director of Fisheries)
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9.2 NATURAL RESOURCES FROM THE SEA AND SOIL

Jenness, Lyle C. (Chemical Engineering Department, University of Maine, Orono, Maine)
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9.3 THE KEEPING QUALITY OF FISH PRODUCTS

Behre, A.
Dtsch. Lebensmitt.-Rdsch 46, 147-150 (1950)

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